# PUBLIC WORKS

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VOL. 71. NO. 6

A. PRESCOTT FOLWELL, Editor

W. A. HARDENBERGH, Asso. Editor

## Timewasters

### A Few Comments:

C. N. Easton works out the pie problem (April issue), suggests that it would make it a wee bit harder to require that all pieces be equal, and ends up by saying: "My wife says that it is the most *idiotic* way to cut a pie. A prophet, you know . . ." I wonder if he tried it out at home. In the same issue, he says that the present age was 25; the philatelist bought 37 at 7 cents, 33 at 5, 16 at 3 and 14 at 2; and the girl at the stamp window won't smile at him any more. Does he try all the problems out on the girls?

Now for the May problems: Major C. R. Steele says that the first grocer had 1, 3 and 9 lb. weights left; and that the second grocer's ham weighed 8 pounds. The clock problem had a catch in it. Major Steele says that it would be 6 mins. 42 seconds past four; but Mr. Blunk, one of our sharks, points out the hands never will be in reverse, if the clock is working right, under those conditions.

### Look Not On the Wine . . .:

A barrel is filled with 5 gallons of wine and another with 10 gallons of water. Three gallons are taken out of each; that from the first barrel is transferred to the second and that from the second is put in the first. This operation is repeated three times. How much wine is there in the second barrel after the third transfer? Thanks to *John Bevan.* WAH

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# Collection and Disposal of Garbage and Refuse in American Cities

*A Survey by the Editors of* **PUBLIC WORKS**

SUPPLEMENTING the information on this subject in the February, 1940, issue of PUBLIC WORKS, there is presented here information collected from 1316 cities in the United States (141 additional cities have since reported, but too late for inclusion). The data, which generally refer to 1939 conditions, are the most complete that have thus far been collected by any agency, we believe, covering in all in both surveys 2,262 municipalities. These range in size from the largest to the smallest and present a detailed cross-section of American practice; statistics are presented that are not available elsewhere and, in fact, are the most detailed since a smaller survey was made by this magazine some thirteen years ago.

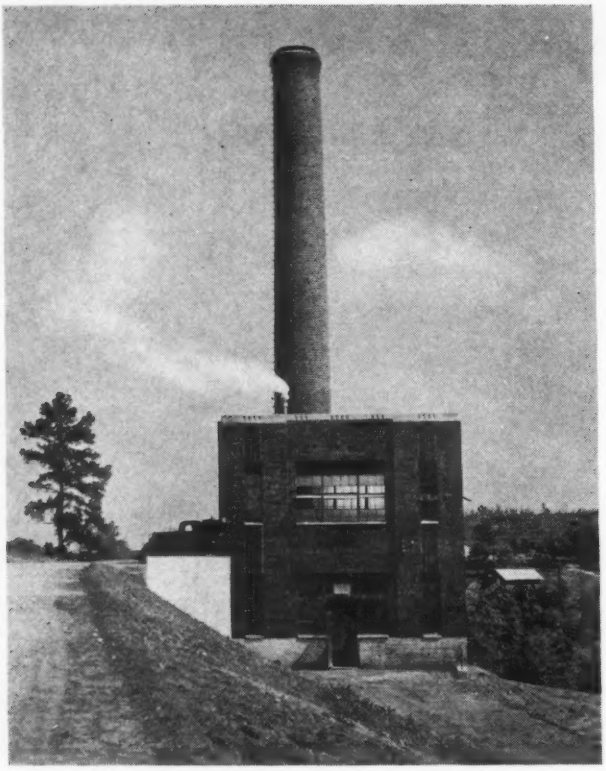
## Frequency and Method of Collection:

The frequency of collections in residential areas for summer and for winter is shown in Table I. These data should be considered also in relation to Table II, in which is shown the number of cities which do not have separate collections of garbage. With rare exceptions, garbage is collected not less frequently than once a week. In the summer, 9.0% provide daily collections, 17.0% provide every other day collections, 46.3% provide two collections a week, and 27.7% provide one collection a week. In the winter, only 4.2% give daily collections, 10.2% every other day collections, 36.4% two collections a week and 49.2% one collection a week. It is interesting to compare these figures with those for smaller municipalities, as given on page 10, February, 1940. PUBLIC WORKS.

In 36.1% of the communities, garbage is collected by city forces, in 31.5% by contract and in 32.4% by private collectors. These data are based on statements by 1,267 cities. It is of interest to note that a much smaller survey in 1927, showed that the figures were 39.9%, 34.8% and 25.3% respectively, indicating that there has been a growth in the use of private collectors. The figures for refuse collection in 1940 are quite materially different, however, with 50.0% collecting by city forces, 15.3% by contract and 34.7% by private forces. All these data are shown in Table II.

An interesting point is the place of collection; the trend has been unmistakably away from curb collection, with the unsightly line-up of garbage and rubbish containers in all stages of decrepitude standing along the street. Of the 1,427 cities reporting on this, 43.8% collect from the back door and 35.9% from the alley, a total of 79.7%; while only 20.3% collect from the curb. As reported in our February issue, the smal-


Garbage Collection unit, Roswell, N. M.



Nichols incinerater at Athens, Ga.

ler communities are not much behind their larger neighbors in this respect, since 73.6% of them reported curb or alley collection. No comparable information was obtained in 1927 on this subject.

## Amount of Garbage and Other Wastes:

Information on the amount of garbage per person per day is given in Tables IIIa and IIIb. The weight of garbage per person per day, shown in Table IIIb, was reported by 18 communities, the average amount being 1.55 pounds per capita per day. The weight of garbage per year per person, shown in Table IIIa, was reported by 42 communities, the average being 435 pounds. If it is assumed that there are 310 collection days, the 1.55 pounds per person per day amounts to 480 pounds per year, checking the annual figures fairly well. It is interesting to note that the 1927 reports showed an average of 314.2 pounds per person per year and commented on the fact that this was nearly twice the "textbook figures" commonly quoted.

MOISTURE CONTENT OF GARBAGE

| | | | |
|---|---|---|---|
| Bakersfield, Calif. | 40% | New York, N. Y. | 75% |
| Berkeley, Calif. | 70 | No. Tonawanda, N. Y. | 50-85 |
| Los Angeles, Calif. | 75 | Port Chester, N.Y. (winter) | 60 |
| Newport Beach, Calif. | 40 | Port Chester, N.Y. (summer) | 50 |
| Pomona, Calif. | 45 | Rochester, N. Y. | 70 |
| San Diego, Calif. | 80-90 | Findlay, Ohio. | 80 |
| San Francisco, Calif. | 50 | Lakewood, Ohio. | 65 |
| Dover, Del. | 60 | Toledo, Ohio. | 80 |
| Wilmington, Del. | 40 | Norman, Okla. | 50 |
| Washington, D. C. | 85 | Elizabeth, Pa. | 85-90 |
| Decatur, Ga. | 40-55 | Erie, Pa. | 25 |
| Chicago, Ill. | 5-20 | Philadelphia, Pa. | 78 |
| Danville, Ill. | 10-18 | Spring City, Pa. | 40 |
| Hinsdale, Ill. | 30 | Uniontown, Pa. | 55 |
| New Orleans, La. | 45-70 | Knoxville, Tenn. | 50 |
| Hagerstown, Md. | 75 | Houston, Tex. | 30-50 |
| Portland, Me. | 25 | Kelso, Wash. | 10 |
| Dearborn, Mich. | 85 | Vancouver, Wash. | 50 |
| Lansing, Mich. | 75 | Yakima, Wash. | 50 |
| Minneapolis, Minn. | 75 | Morgantown, W. Va. | 20 |
| Asbury Park, N. J. | 60-80 | Powell, Wyo. | 20 |
| Princeton, N. J. | 70 | | |

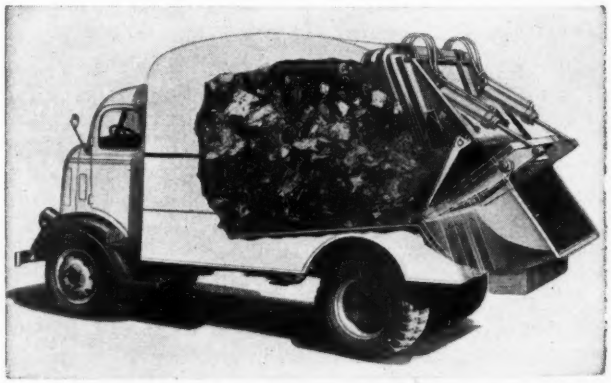
Table VII—Moisture Content

Garbage Collections -- Residential Areas

| State | Summer -- per week Six | Three | Two | One | Winter -- per week Six | Three | Two | One |
|---|---|---|---|---|---|---|---|---|
| Alabama | 1 | 2 | 5 | 2 | .. | 2 | 5 | 2 |
| Arizona | 2 | 4 | 1 | 1 | .. | 3 | 1 | 1 |
| Arkansas | 1 | .. | 3 | 3 | 1 | .. | 2 | 4 |
| California | .. | 7 | 39 | 24 | .. | 5 | 40 | 24 |
| Colorado | 1 | 4 | 10 | 1 | .. | 2 | 11 | 2 |
| Connecticut | .. | 5 | 9 | 1 | .. | 1 | 13 | 4 |
| Delaware | .. | 1 | 3 | .. | .. | .. | 4 | .. |
| D. C. | .. | 1 | .. | .. | .. | .. | 1 | .. |
| Florida | 3 | 5 | 8 | 1 | 3 | 4 | 10 | 1 |
| Georgia | 4 | 3 | 10 | 1 | 2 | 3 | 8 | 3 |
| Idaho | 1 | .. | 4 | 3 | 1 | .. | 1 | 6 |
| Illinois | 4 | 10 | 21 | 8 | .. | 7 | 14 | 22 |
| Indiana | 2 | 6 | 12 | 9 | .. | 11 | 9 | 21 |
| Iowa | 2 | 6 | 18 | 4 | .. | 1 | 11 | 14 |
| Kansas | 8 | 5 | 9 | 3 | 3 | 5 | 12 | 6 |
| Kentucky | 3 | 1 | 5 | .. | 1 | .. | 5 | 3 |
| Louisiana | 5 | .. | .. | 1 | 4 | 1 | .. | 1 |
| Maine | 1 | .. | 11 | 5 | 1 | .. | 4 | 12 |
| Maryland | .. | 1 | .. | .. | .. | .. | 1 | .. |
| Massachusetts | 6 | 4 | 29 | 8 | 1 | 3 | 23 | 19 |
| Michigan | .. | 5 | 38 | 14 | .. | 1 | 17 | 32 |
| Minnesota | 3 | 10 | 12 | 8 | 2 | 4 | 7 | 16 |
| Mississippi | 2 | 4 | .. | 2 | 1 | 3 | 2 | 2 |
| Missouri | 7 | 2 | 7 | 3 | 4 | 1 | 4 | 7 |
| Montana | .. | .. | 2 | 8 | .. | .. | 1 | 7 |
| Nebraska | 2 | 2 | 4 | 2 | 1 | .. | 3 | 5 |
| Nevada | .. | .. | .. | 2 | .. | .. | .. | 2 |
| New Hampshire | .. | .. | 1 | 4 | .. | .. | 1 | 4 |
| New Jersey | 7 | 21 | 20 | 4 | 4 | 16 | 18 | 11 |
| New Mexico | 1 | 1 | 3 | .. | .. | 1 | .. | 1 |
| New York | 6 | 11 | 34 | 28 | 3 | 9 | 28 | 40 |
| No. Carolina | .. | 6 | 12 | 4 | .. | 5 | 9 | 9 |
| No. Dakota | .. | .. | 7 | 3 | .. | .. | 3 | 5 |
| Ohio | .. | 3 | 25 | 36 | .. | 1 | 11 | 45 |
| Oklahoma | 2 | 4 | 7 | 5 | 1 | .. | 6 | 11 |
| Oregon | 1 | .. | 6 | 8 | 1 | .. | 4 | 8 |
| Pennsylvania | 6 | 13 | 50 | 26 | 2 | 4 | 31 | 54 |
| Rhode Island | .. | 3 | 1 | .. | .. | .. | 2 | 1 |
| So. Carolina | 1 | 2 | 4 | 1 | 1 | 1 | 4 | 2 |
| So. Dakota | 1 | 4 | 3 | 5 | .. | .. | 4 | 8 |
| Tennessee | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 3 |
| Texas | 8 | 7 | 12 | 7 | 4 | 5 | 12 | 9 |
| Utah | 1 | .. | .. | 3 | .. | .. | .. | 4 |
| Vermont | .. | 1 | 6 | 1 | .. | .. | 2 | 6 |
| Virginia | .. | 9 | 13 | 4 | .. | 2 | 12 | 11 |
| Washington | .. | 1 | 2 | 17 | .. | .. | 2 | 16 |
| West Virginia | 1 | .. | 3 | 6 | .. | 1 | 3 | 5 |
| Wisconsin | 2 | 4 | 19 | 13 | .. | .. | 6 | 25 |
| Wyoming | .. | 1 | 1 | 1 | .. | .. | .. | 3 |

Table I—Collection Frequency

While every effort was made, in collecting the information, to have figures apply to amount of garbage only, it is likely that some reports may include combustible wastes which are often included with and classified as garbage.



Phantom view of the Gar Wood Load-Packer body, showing tight body and low loading.

| WEIGHT OF GARBAGE IN POUNDS PER PERSON PER YEAR | |
|---|---|
| Newport Beach, Calif. | 600 |
| Redlands, Calif. | 310 |
| San Diego, Calif. | 440 |
| South Gate, Calif. | 208 |
| Washington, D. C. | 315 |
| Coral Gables, Fla. | 1000 |
| Tallahassee, Fla. | 1262 |
| Columbus, Ga. | 660 |
| Chicago, Ill. | 395 |
| Hinsdale, Ill. | 550 |
| Western Springs, Ill. | 360 |
| Winnetka, Ill. | 363 |
| Richmond, Ind. | *150 |
| Tipton, Ind. | *300 |
| Cedar Rapids, Ia. | 267 |
| Manhattan, Kan. | 233 |
| Topeka, Kan. | 178 |
| New Bedford, Mass. | 228 |
| Springfield, Mass. | 219 |
| Dearborn, Mich. | 769 |
| Essexville, Mich. | 1000 |
| Highland Park, Mich. | 178 |
| Lincoln Park, Mich. | 200 |
| Pontiac, Mich. | 330 |
| Mankato, Minn. | 482 |
| Minneapolis, Minn. | 200 |
| Perth Amboy, N. J. | 486 |
| Niagara Falls, N. Y. | 433 |
| No. Tonawanda, N. Y. | 375 |
| Wellsville, N. Y. | 532 |
| Columbus, Ohio. | 176 |
| Hamilton, Ohio. | 386 |
| Lakewood, Ohio. | 472 |
| Toledo, Ohio. | 194 |
| Lower Merion Twp., Pa. | 450 |
| Mundhall, Pa. | 200 |
| Philadelphia, Pa. | 196 |
| Wyomissing, Pa. | 666 |
| Kenosha, Wis. | 880 |
| Milwaukee, Wis. | 160 |
| Oshkosh, Wis. | 670 |

| WEIGHT OF GARBAGE IN POUNDS PER PERSON PER DAY | |
|---|---|
| Burbank, Calif. | 0.24 |
| Long Beach, Calif. | 1.75 |
| Los Angeles, Calif. | 0.84 |
| Oxnard, Calif. | 2.75 |
| Danville, Ill. | 0.33 |
| Oak Park, Ill. | 1.48 |
| Des Moines, Ia. | 2.60 |
| Winfield, Kan. | 1.5 |
| New Orleans, La. | 1.21 |
| Arlington, Mass. | 2.0 |
| Brockton, Mass. | 2.2 |
| Lansing, Mich. | 0.5 |
| Greenville, Miss. | *2.0 |
| Fallen, Nev. | 2.2 |
| Port Chester, N. Y. | 3.0 |
| Sea Cliff, N. Y. | 2.0 |
| Grand Forks, N. D. | 1.0 |
| Greendale, Wisc. | 0.33 |

| COMPARISONS ON REPORTS OF WEIGHT IN POUNDS OF GARBAGE PER PERSON PER YEAR | |
|---|---|
| Cities Over 100,000 (8) | |
| Average | 240 |
| Maximum | 440 |
| Minimum | 160 |
| Cities 10,000-100,000 (17) | |
| Average | 590 |
| Maximum | 1262 |
| Minimum | 150 |
| Cities Under 10,000 (7) | |
| Average | 355 |
| Maximum | 666 |
| Minimum | 200 |

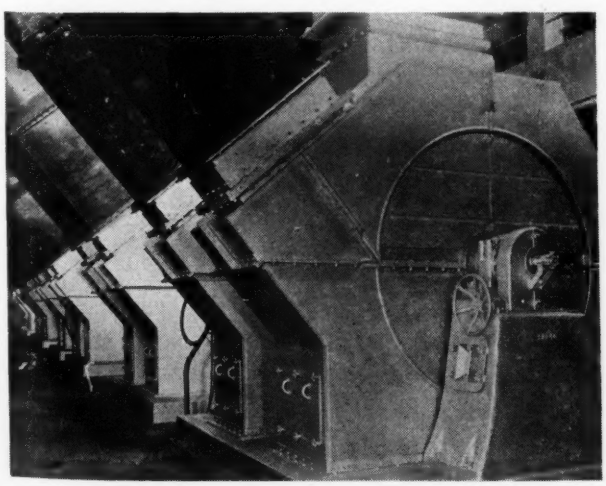
* Estimated

**Tables IIIa and IIIb—Weight of garbage**

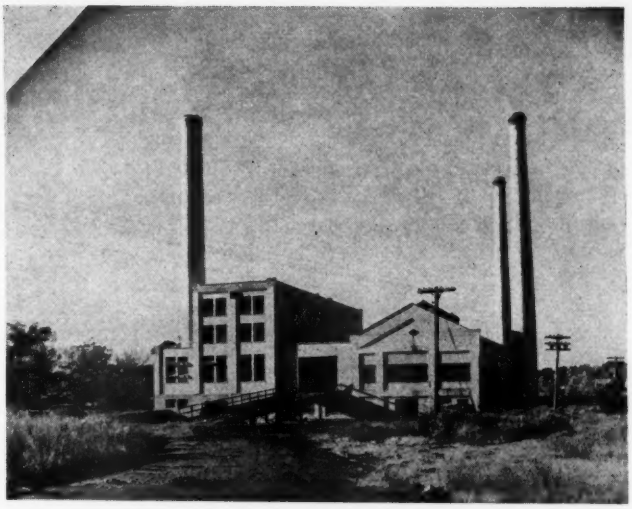
A number of other communities reported on the amount of garbage produced, or where mixed collection is the practice, on the amount of this. Instead of converting these to figures based on an assumed or estimated population, they are presented "as is" with the feeling that they are more valuable on that basis. Population figures for 1940 will soon be available and in connection with the data in Tables IV and Va, and Vb, additional computations can be made which will reinforce the data already presented in Tables IIIa, and IIIb.

## Moisture Content and Weight of Garbage:

Table VI shows the weight per cubic yard of garbage as reported by 80 cities; the moisture content, as



**Sixteen flash driers of C-E Raymond System at Chicago Southwest plant, capacity 375 tons of dry solids per day.**



**Morse Boulger Destructor at New Rochelle, N. Y.**

reported by 42 cities is shown in Table VII. These figures refer in many cases to the cities enumerated in Table IV, and allow, when a population is assumed, a close determination of the amount of garbage produced.

## Disposal Methods:

A total of 1,367 cities reported on the methods of disposal of garbage, as shown in Table VIII. Of these, 220 reported disposal by incineration, or 14.6%. This compared with 4.8% reported by the smaller communities. Only 10 cities reported disposal of gar-

**(Continued, with more data, on page 31)**

| States | No. Sep. Coll. | Garbage Collected by City | Garbage Collected by Cont. | Garbage Collected by Priv. | Refuse Collected by City | Refuse Collected by Cont. | Refuse Collected by Priv. | Collections from Curb | Collections from Alley | Collections from Bk.Door |
|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | 6 | 11 | .. | .. | 4 | .. | .. | 6 | 6 | 6 |
| Arizona | 6 | 4 | 2 | .. | 1 | 1 | .. | 4 | 6 | 2 |
| Arkansas | 5 | 3 | .. | 5 | 4 | .. | 2 | 1 | 2 | 5 |
| California | 29 | 19 | 43 | 17 | 20 | 18 | 10 | 26 | 33 | 35 |
| Colorado | 4 | 1 | 14 | 6 | 4 | 5 | 8 | .. | 16 | 2 |
| Connecticut | 3 | 7 | 8 | 6 | 5 | 4 | 7 | 3 | 1 | 16 |
| Delaware | 1 | 3 | 1 | .. | 3 | .. | .. | 1 | 1 | 3 |
| D. C. | 1 | 1 | .. | .. | 1 | .. | .. | 1 | 1 | .. |
| Florida | 7 | 15 | 3 | 1 | 8 | 1 | 2 | 5 | 7 | 15 |
| Georgia | 13 | 17 | .. | .. | 4 | .. | .. | 5 | 8 | 12 |
| Idaho | 2 | 2 | 5 | 3 | 3 | 3 | 2 | .. | 8 | 1 |
| Illinois | 18 | 31 | 11 | 16 | 30 | 4 | 13 | 13 | 27 | 24 |
| Indiana | 8 | 12 | 16 | 10 | 15 | 4 | 9 | 12 | 33 | 9 |
| Iowa | 15 | 7 | 8 | 22 | 8 | 1 | 13 | 4 | 20 | 11 |
| Kansas | 10 | 5 | 7 | 18 | 10 | 3 | 12 | 3 | 26 | 11 |
| Kentucky | 2 | 7 | .. | 5 | 5 | 1 | 3 | 4 | 5 | 5 |
| Louisiana | 1 | 6 | .. | .. | 5 | .. | .. | 5 | 1 | 1 |
| Maine | 2 | 5 | 9 | 7 | 6 | .. | 6 | 4 | .. | 13 |
| Maryland | .. | 1 | .. | .. | 1 | .. | .. | 1 | .. | .. |
| Massachusetts | 2 | 12 | 35 | 5 | 26 | 5 | 14 | 3 | 1 | 45 |
| Michigan | 7 | 23 | 25 | 11 | 34 | 6 | 7 | 9 | 20 | 35 |
| Minnesota | 22 | 14 | 8 | 23 | 12 | 2 | 15 | 2 | 25 | 13 |
| Mississippi | 6 | 8 | .. | 1 | 1 | .. | 1 | 3 | 4 | 4 |
| Missouri | 7 | 2 | 1 | 24 | 7 | .. | 17 | 1 | 15 | 14 |
| Montana | 11 | 8 | 1 | 5 | 1 | 1 | 3 | .. | 14 | .. |
| Nebraska | 9 | .. | 4 | 7 | .. | 1 | 5 | 1 | 8 | 6 |
| Nevada | 1 | 1 | 1 | .. | 1 | .. | .. | .. | 1 | 1 |
| New Hampshire | 1 | 3 | 1 | 2 | 4 | .. | .. | 3 | .. | 2 |
| New Jersey | 29 | 17 | 27 | 11 | 10 | 8 | 8 | 27 | 5 | 19 |
| New Mexico | 1 | 2 | 2 | 1 | 2 | 2 | .. | .. | 5 | 1 |
| New York | 29 | 32 | 41 | 19 | 30 | 16 | 5 | 27 | 5 | 55 |
| No. Carolina | 21 | 23 | .. | .. | 4 | .. | .. | 11 | 8 | 12 |
| No. Dakota | 5 | 3 | 4 | 5 | 2 | 2 | 3 | 1 | 12 | 2 |
| Ohio | 14 | 20 | 19 | 34 | 25 | 5 | 28 | 10 | 20 | 54 |
| Oklahoma | 11 | 6 | 10 | 12 | 8 | 6 | 4 | 2 | 18 | 4 |
| Oregon | 12 | .. | 2 | 16 | 3 | 1 | 5 | 2 | .7 | 17 |
| Pennsylvania | 45 | 24 | 44 | 50 | 29 | 14 | 41 | 32 | 30 | 69 |
| Rhode Island | .. | .. | 4 | .. | 2 | 1 | 1 | .. | .. | 4 |
| So. Carolina | 9 | 7 | .. | .. | 1 | .. | .. | 3 | 4 | 4 |
| So. Dakota | 8 | 7 | 3 | 7 | 3 | 1 | 7 | 1 | 14 | 6 |
| Tennessee | 6 | 6 | .. | 2 | 3 | .. | 1 | 3 | 3 | 5 |
| Texas | 25 | 24 | 2 | 21 | 20 | 2 | 7 | 16 | 32 | 12 |
| Utah | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 5 | 2 | 2 |
| Vermont | 3 | .. | 3 | 6 | 1 | .. | 5 | .. | .. | 9 |
| Virginia | 12 | 21 | 2 | 3 | 13 | 2 | .. | 13 | 16 | 9 |
| Washington | 14 | 5 | 12 | 5 | 5 | 2 | 2 | 4 | 14 | 12 |
| West Virginia | 8 | 8 | 3 | 1 | 1 | 1 | 2 | 5 | 7 | 6 |
| Wisconsin | 23 | 18 | 13 | 17 | 18 | 3 | 11 | 8 | 14 | 31 |
| Wyoming | 6 | 3 | 2 | 5 | 2 | . | 1 | .. | 7 | 1 |

**Table II—Methods of Collection**

A section of completed road

# Pebble Top-Soil Base for Surface Treatment With 1½-Inch Amiesite Wearing Surfaces

By C. E. LAYTON

City Engineer Statesboro, Ga., and Engineer for Bulloch Co.

ROAD and street work in this county and this city is progressing very rapidly now since we have shown how local pebble top soil can be used to construct road and street bases which, when topped off with a single surface treatment of 1½-inch Amiesite cold mix gives a very good paved surface at a small cost.

This county has plenty of pebble top soil for such work but the property owners are somewhat reluctant in letting us have it as it is generally the best corn and cotton land in cultivation.

In preparing a street or road for surfacing I take special pains in getting the sub-grade in good shape with all ditches and fills well settled before putting on the top soil. The soil pit is cleaned of all vegetable matter and then plowed and mixed with a disc harrow; if a shovel is to be used for loading the material it is first machined into large windrows with tractor and blade; but if it is to be loaded by hand this is not necessary. In taking off the first layer the pit is machined down to the clay which varies in depth from 6 ins. to 12 ins., and this is watched very closely so that we do not get too much of this clay in our soil.

The soil is hauled to the street or road in dump trucks, and spread to a loose depth of 9 inches which, when compacted and finished will provide a 6-inch base; this soil is full of pebbles and coarse sand, but sets up when it is properly mixed, machined and watered.

The soil base is kept in a reasonably smooth condition for at least two or three weeks, the road meanwhile being open to travel; also we instruct our own truck drivers never to drive in ruts so that the full width will compact together at the same time. Loose material on the road should never be scarified; plenty of moisture from rains (and not from sprinkler wagons) should be present before finishing.

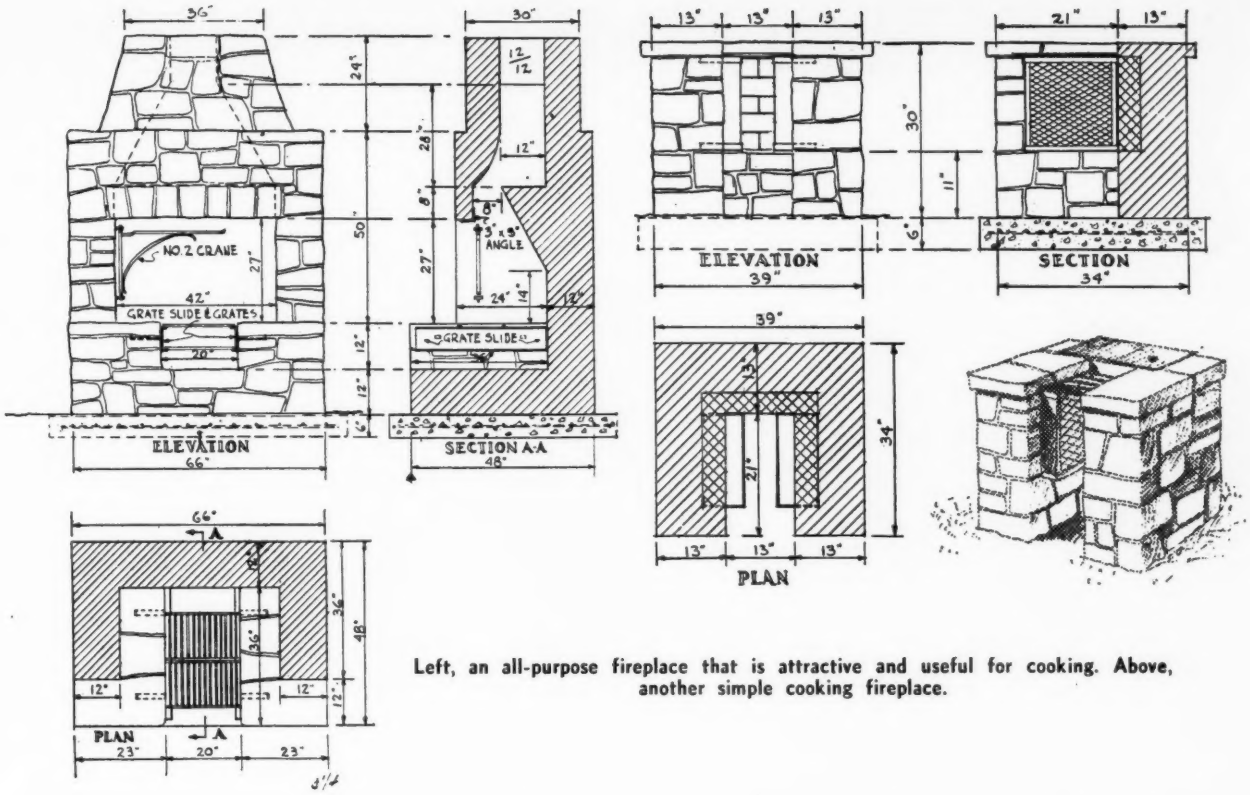
One tractor and road machine will scarify, disc and machine ½ mile of road per day 20 feet wide, or ¼ mile of city streets 30 feet wide, where there are curbs, gutters and intersections to contend with. Smooth track tractors and rubber tired motor or blade graders must be used for this work. After scarifying about 4 ins. deep, the soil is mixed and pulverized with a disc harrow; then it is backed off evenly to each side. This next operation is very important as it is possible to bring back only a small amount on each trip of the grader. This should be continued until all the soil is in place and at the desired cross section. The crown should be 1½ ins. higher and the edges ¾ ins. higher than the finished section; all surplus soil should be moved off onto the shoulder or into the gutter and hauled off.

As soon as the proper cross-section has been obtained and all dips and ridges machined, the water sprinklers put just enough water on so that the soil will not rut but will keep in a damp condition. For the first two or three days the surface should be given a light machining with the blade by backing it off; never pull it in after starting the water sprinklers as this will cause skin patches. Open the road for travel as soon as it is damp and close it only when a hard rain comes, so that no ruts or pot holes will be made by the traffic. The more traffic you have the quicker the surface will develop and set up.

It may be desirable to control traffic by laying blocks in the road so as to develop the edges; this is important and often must be watched as traffic tends to use the center and it may be necessary to put trucks on the edges to help development. A roller is not necessary for this work, though I have used them some when I had one available.

It is very difficult to tell when the base is ready to prime; this has to come through experience; it depends on your traffic, your sprinklers and weather conditions. However it generally takes, under ordinary conditions, two weeks and sometimes a month to develop the surface. It has been my motto "Do not prime it until you have had at least one good rain on it after two weeks of developing." It must be kept damp so that it will not ravel.

After getting this desired rain let the surface dry out for one day and then plane it lightly with the road machine or motor grader and sweep clean just before priming. Adjust your mold board on the machine forward as far as possible so that it will rub off instead of cut; most machines are not properly made for this work and it will be necessary to extend the adjusting arms; and the machines must travel at a low rate of speed. Following these directions, the machine man can plane off all ridges and get the surface to the final section. Following machining, the surface is primed with 0.35 gals. per the sq. yd. of TC-2, Georgia Highway Dept. specifications (Cold Tar prime); as soon as this prime coat cures it is ready for most any kind of top that you wish to put on.



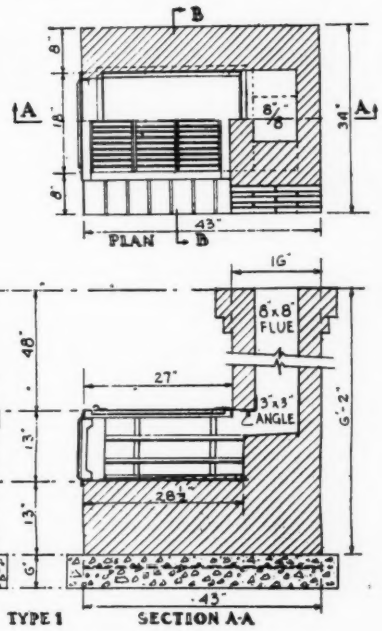

Left, an all-purpose fireplace that is attractive and useful for cooking. Above, another simple cooking fireplace.

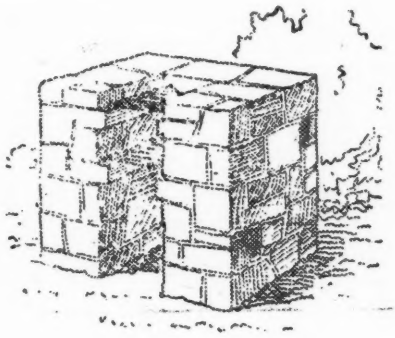
# How to Build Outdoor Fireplaces for Parks and Recreation Areas

OUTDOOR cooking places and fireplaces are often desirable in parks and recreation areas. Herewith are shown, through the courtesy of Donley Bros. Co., a number of designs suitable for such installations, with dimensions and some data on cooking equipment, as grates and cranes.

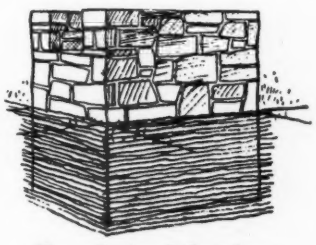
In cold climates, foundations should be carried well below the ground; but this is not necessary where frost does not penetrate deeply. A reinforced concrete mat may be used instead of the deep footings as a support for the smaller structures; larger units should be carried down sufficiently to prevent damage.

Since chimneys are low and the fuel used is often quick burning, wire chimney guards may be used to prevent sparks from flying out and causing a fire hazard. Many other accessories are available for use with such fireplaces, including grills, range units and dutch ovens.



Left, simple cooking fireplace with grids at two levels.

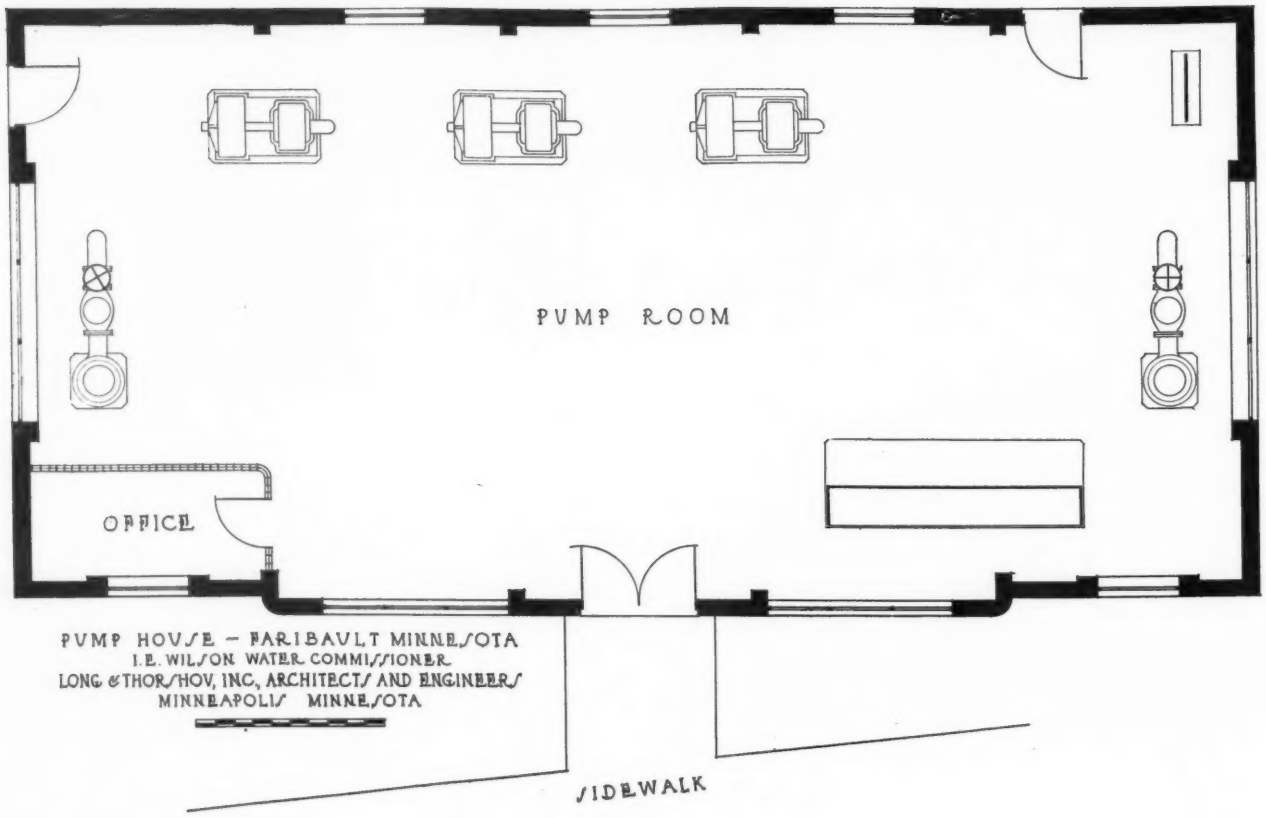


*Foundation below frost.*


*In frostless climates.*

*Concrete matte.*

# Attractive Water Works Plants—




AT THIS plant, two wells, one at each end of the building, 24" x 750 and 440 feet in depth, respectively, supply the water. These are equipped with turbine motor driven pumps of 125 hp., each with a normal capacity of 3,600,000 gpd., discharging into a 1,000,000 gal. concrete sedimentation and storage reservoir. Three motor driven horizontal centrifugal high duty pumps with normal capacities of 1,580,000 and 2,088,000 gallons daily, discharge through the system at 120 lbs. pressure into two high level concrete reservoirs of 1,000,000 and 2,000,000 gal. capacity. One turbine and one high duty unit only are normally operated at the same time. The five pumps in the pumping station are driven as individual units with individual motors.

### Electrical Equipment Data

Two of these motors are rated 150 HP, two at 125 HP, and one at 100 HP, all 2300 volt, 3 phase, 60 cycle. All of these motors are started or controlled by means of individual manual type, reduced voltage starters, furnishing both overload and undervoltage protection. The overload protection is obtained by using the "Thermal overload relay" which is connected in the control circuit of the starter in such a manner that, if the motor involved continues for a period of time to carry an overload drawing an excess of full load current, this overload current will cause the overload relay to operate, which in turn opens the low voltage release circuit and causes the motor starter to be automatically placed in the off position. It is absolutely necessary in the event of an interruption during motor operation caused by overload that the overload relays be reset manually or by the operator before the motor can be restarted.

The 2300-volt supply for the pumping station is normally secured from the local power feeder which enters underground. Upon this feeder entering the building, there is connected in series a set of three-phase manually operated disconnecting switches mounted on the 2300-volt bus structure or other 2300-volt equipment in the station, with these switches in the "open or disconnected" position for safety. The

Some of the pumping units

# The Faribault, Minn., Pumping Station

**Long and Thorshov, Inc., Minneapolis, Minn., were the architects on this structure and have furnished the data below and the drawings. I. E. Wilson is Water Commissioner and supplied the photographs.**

2300-volt supply is then continued underground feeding to another set of three phase disconnect switches mounted on the interior structure of the station incoming line power feeder panel, which then continues through a manually operated oil circuit breaker, also on the station incoming line panel.

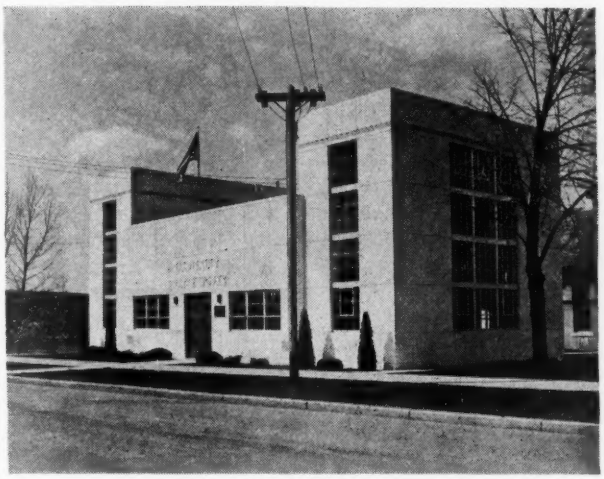
The station switchboard is of an ultra modern all steel design, having unusual eye appeal, is made of seven panel sections each panel with its own disconnecting switches installed on the interiors of the steel structure sections.

### Standby Power Provisions

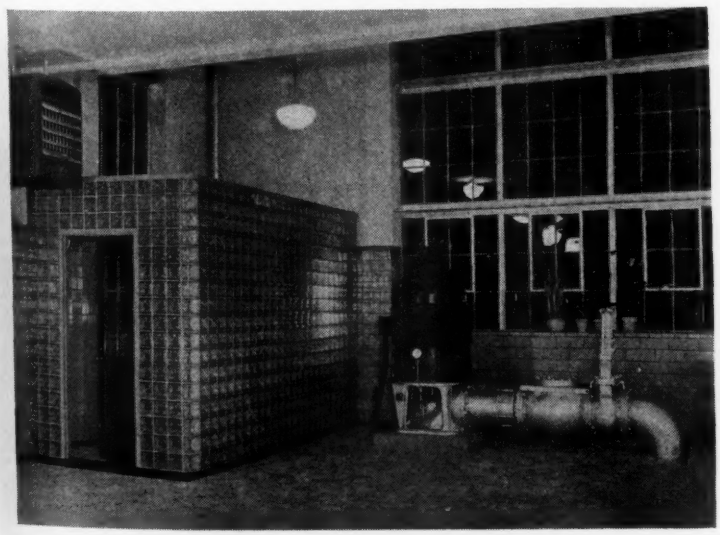
There is a station generator panel unit for the complete control of the gasoline engine driven emergency generator which can be used in any emergency case caused by fire, storm or other sources, if the local power service is interrupted. This panel is completely equipped with the necessary meters, instruments, and meter transfer switches enabling the operator to determine at a glance the conditions under which the station generator is operating.

The transfer switches involve single ammeter, voltmeter, and wattmeter, and are of the rotating definite position type, permitting the operator to check one phase load condition against the other phases of any of these instruments by rotating the proper handle.

A separate incoming line panel unit is mounted adjacent to the station generator panel unit and is equipped with a manually operated oil circuit breaker for opening and closing the power feeder circuit. There is also a set of three-phase disconnect switches mounted on the interior of this panel steel structure. This panel is also equipped with an individual ammeter, making it possible to determine the ampere load that is being consumed by the apparatus in operation. There are also instrument transfer switches on this panel, making it possible to check against any unbalanced load condition on the power line and any unbalanced load condition that may exist which would signify trouble or overload. The oil circuit breakers on the station generator panel and the incoming power line panel are electrically interlocked. This means that it is impossible for the operator to close both of these circuit breakers at the same time, making it necessary to select the source of power to be used closing this particular service breaker and making it possible to close the opposite circuit breaker.



The plant exterior is highly attractive.



Glass blocks make a light and attractive office.

Both of these oil circuit breakers are connected in such a manner that a common three-phase bus, which acts as a feeder bus for all of the motor starters, is energized from the selected source of power. This bus will continue to have a voltage of 2300 volts (which may be called a 2300-volt main bus) and is arranged inside of the various steel structure panel sections in a horizontal plane, this permitting connections to be taken from the main three phase bus to a separate and individual set of disconnecting switches furnished with each pump motor control panel section. This individual motor disconnect idea is very advantageous as with this arrangement any one of the motors, which are 2300-volt units, as well as the reduced voltage pump motor starters can be safely worked on after the particular starter or starters disconnecting switches have been opened, without danger.

Each individual starter panel is equipped with an ammeter of a suitable size for the particular motor with which it will be used. The panel is also equipped with an ammeter transfer switch which makes it pos-

sible for the operator to check the motor ampere phase load, which will signify to the operator any unbalanced condition or that there is trouble in the motor; this often prevents serious damage or motor burnouts that may not have been detected if it were not for these ammeter transfer switches.

Each starter panel is also equipped with a wattmeter rotary transfer switch. This switch permits a much closer check of the motor output or motor load. Although each starter panel is equipped with a wattmeter transfer switch there is only one wattmeter which indicates the load reading in watts located on the station generator panel; but due to interconnecting of the various wattmeter transfer switches with this one wattmeter, it is possible to check the motor load output of any one motor or the generator from this one instrument merely by operating the transfer switch on the individual motor or generator involved.

One type M Venturi Meter and necessary pressure gauges are conveniently mounted together on a concrete base. No basement, sewer system or toilet fixtures of any kind were provided in compliance with sanitary regulations of the Minnesota State Board of Health.

All distribution mains are cast iron. There are 4.4 miles of 4″, 32.0 miles of 6″, 6.4 miles of 8″, 0.2 miles of 10″ and 3.3 miles of 12″. A contract also has been awarded for 3,500 feet of 20″ cast iron pipe, the initial section of a proposed equalizing main to be constructed through the center of the distribution system.

The Faribault Water Department has been free from bonded debt or incumbrance of any kind since 1930. The present estimated population of Faribault is 13,950.

## Amount of Domestic Consumption of Water

"DOMESTIC CONSUMPTION," the subject of a study by American Water Works & Electric Co., Inc., means all water used generally in or about the home. Included is such water needed for bathing, drinking, toilets, laundering, kitchen, cleaning, lawn sprinkling and automobile washing.

At a majority of the companies in that system all customers are metered. There are a few plants, however, where domestic customers are served on a flat or assessed rate basis, and for such customers the domestic consumption necessarily can only be estimated. In addition, there are a few instances where a wide variation exists between the permanent and seasonal population of a community. In such cases an average has been established. The tabulation is based upon the records for 1939.

According to records, the price charged for water does not seem greatly to affect domestic usage. Two items in the realm of nature that have an effect are, of course, temperature and rainfall. Therefore, before attempting any comparisons, the reader should remember that the weather also must be considered.

Taken as a whole, the data indicate the existence of an ample field for the sale of additional water. Certainly every community has homes in need of additional or modernized plumbing. The sponsoring of better lawns and garden campaigns surely is within the dictates of civic pride. Personal cleanliness, besides being its own reward, deserves continual promotion as a healthful habit. In fact, it is safe to say that practically every plan promoting greater water consumption by the domestic consumer reacts favorably for the whole community.

Reports from 77 plants, serving a total of 3,277,700 population, with 535,558 customers, of which 91 per cent are metered, show an average daily consumption of 123 gallons. The highest recorded domestic consumption was 264 gallons per customer per day in Greenwich, Conn., followed by 232 gallons per customer per day for New Rochelle, N. Y.

The lowest recorded use was at the Rainey plant, where the use per customer per day was 61 gallons; this was closely followed by Mt. Jewett (population 1400) with 62 gallons. At 30 of the 77 plants, consumption per customer per day was less than 100 gallons; at 6 plants it was 200 gallons or over.

The Greenwich and New Rochelle systems are 100 per cent metered; the Mt. Jewett plant is also 100 per cent metered, but the Rainey plant is only 1 per cent metered. Of the 77 plants, 41 are 100 per cent metered.

## Getting Rights of Way for Farm to Market Roads

On each mile of farm to market road there are an average of six property owners. This group is equal to an additional unit of government, and the county highway department sponsoring a farm to market road is the "middleman" between this group and the state highway department. In many cases this group of property owners has not been given the proper consideration.

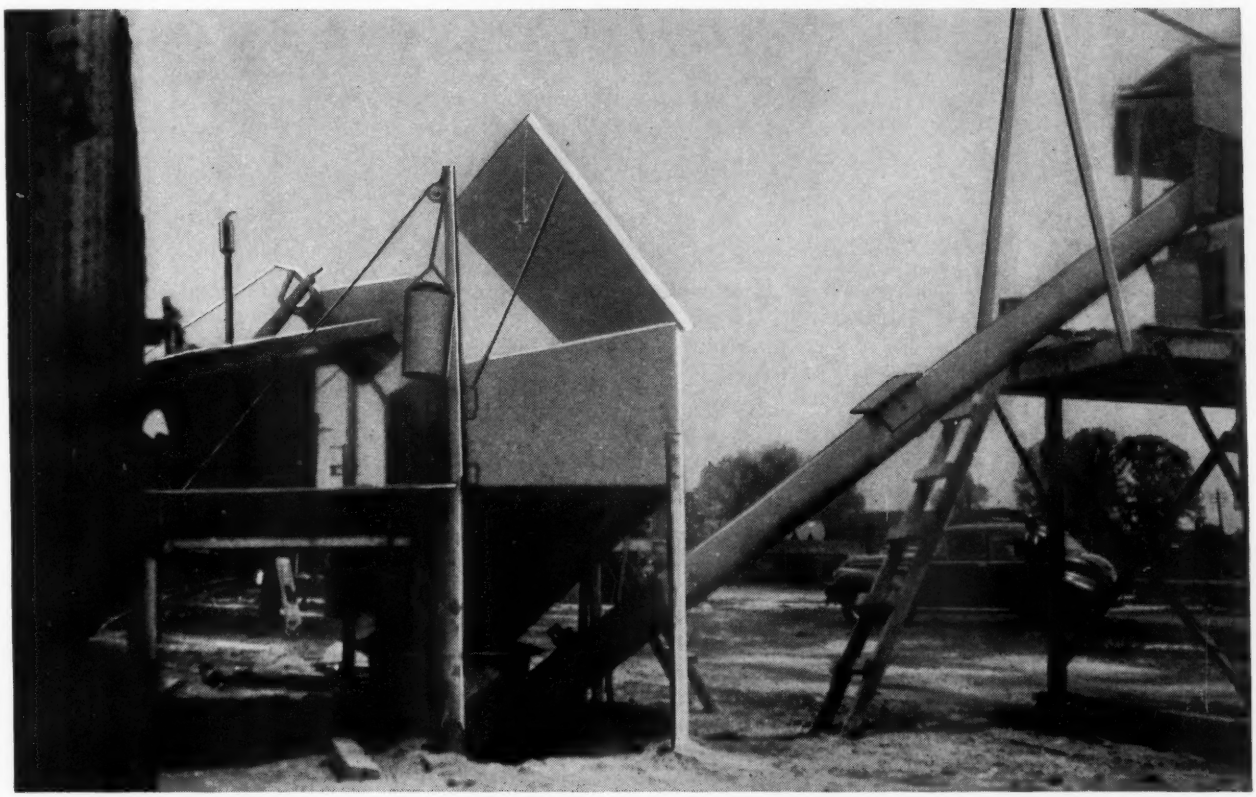
Don't proceed backwards in promoting one of these farm to market roads, by selecting the road, making all surveys and plans, and then attempting to get the right of way grants. A better plan is to make verbal arrangements with your state highway district engineer fixing the width of right-away, type of construction, changes in location, etc. which are all vital to the property owners. At this point, call a meeting of all the property owners adjoining the proposed road and present the plan to them for their approval.

The trend now is towards a dustless road, and in offering this type of road to a group of property owners it will be much easier to get their full cooperation than by simply telling them the road is going to be built regardless of their wishes. Inform them that if they do not avail themselves of the opportunity some other section of your county will get this improved road. If the funds are not used in your county, they will be used in some other county in the state.

This procedure was followed in Wayne County in obtaining right-of-way for a farm to market road. On the day of the meeting, 17 out of 18 interested property owners agreed to grant the right-of-way for an 80-foot road, for the consideration of the construction of or reconstruction of the fences. We had one holdout from whom we found it entirely impossible for us to get a right-away grant. But with 17 property owners signed in favor of the road, public sentiment was so strong that the commissioners felt justified in bringing condemnation proceedings. Court action is still pending. But using the figure as allowed by the viewers, appointed by the court, the total cost to the county of resetting fences, moving one house and another building was $2,987.03, or $702.83 a mile for an 18-foot black-top road with 6-foot berms on an 80-foot right-of-way. We consider this a worth while project.

This is abstracted from a paper presented by Ernest H. Coffin, Road Supervisor, Wayne Co., Ind., before the Purdue Road School.

# Concrete Highway Widening Utilizes New Equipment and New Methods

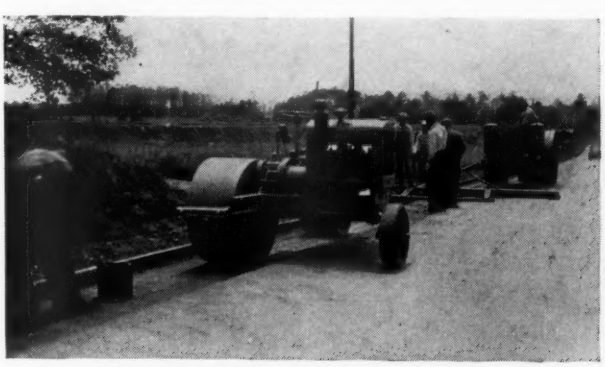


**The set-up for handling bulk cement. The cement hog is about to dump into the hopper. At right, the batching plant.**

MODERN methods, up-to-date equipment and new ideas are illustrated in a concrete highway widening and construction job northwest of Charlotte, N. C. The widening now going on is but a small part of the work which involves also the construction of a new concrete highway. The work is being carried on by the Brown Paving Co., Lexington, N. C. W. F. Brown, president, with headquarters at Lexington, is actively in charge of the work. F. N. Thompson, Charlotte, is vice-president. L. B. Peck is Division Engineer of the North Carolina State Highway and Public Works Commission, with headquarters in Charlotte. W. A. Little is resident Engineer in charge.

All grading operations have been completed and concrete is now being placed on the section being widened. This involves laying a 4-ft. wide strip, and the work is being carried on at the rate of nearly a mile a day. A Galion motor grader is being used to cut out the shoulder for widening. After placing the form, a subgrade scraper or planer, with one end supported on the form and the other end riding the pavement, is hauled along with a power roller. A full length planer is used, as shown in the illustration. The planed subgrade is then rolled with a Galion trench roller, also shown. Since the widening work is relatively small, the contractor rents this equipment.

Materials are shipped into Charlotte, where bulk cement arrives in boxcars. The bulk cement is unloaded by means of a Butler Cement Hog, a compact tractor with a hydraulic operated scoop which digs the cement out of the car and dumps it into a 115-cu. ft. receiving hopper at the car door. An inclined screw conveyor driven by a gasoline engine and controlled by a clutch on the batching platform carries the cement from here to an enclosed weighing hopper, from which it is dumped into the batch trucks on top of the



**Galion trench roller on widening work.**


**A scoopful of bulk cement about to be dumped. The unit maneuvers readily in a standard box car.**

aggregates by means of a telescoping rubber loading nose. The entire unit was furnished by the Butler Bin Company.

Meanwhile, the sand and stone has been dumped into the batch trucks from a Butler bin loaded by a Northwest crane. To prevent loss of bulk cement en route, the batch trucks (mostly Dodge) are provided with a canvas cover overlapping the entire body and weighted at the edge.

The bulk cement handling apparatus is comparatively dustless, except at the actual moment of discharge into the bin from the bulldozer scoop, when there is some dust.

The batch trucks dump into the hopper of a Ransome dual drum paving mixer, which is equipped with an oversize drum. Finishing is by an old type Ord finisher now used by the contractor only for widening work. Curing is with burlap.

One of the most interesting phases of this job was the method of providing water for the widening operations. Instead of the usual pipe line, the contractor hauls water in 800-gallon tank trucks. The tank truck is spotted ahead of the mixer and moves forward by short bounds. Behind the truck is chained a Jaeger centrifugal pump which draws water from the tank truck and delivers it to the mixer through hose lines,

**Jaeger pump furnishes water for widening operations.**

The tank truck, moving forward at such a rate and at such times as to keep the hose lines clear, draws the pump behind it. When the tank is empty, the pump is disconnected, another tank truck is backed into place, and the water unit reconnected. This arrangement is flexible and economical for widening as compared to providing water by the usual pipe line. Tank trucks also provide the water necessary for curing.

In late April, this widening work was progressing at the rate of 700 feet per hour, the concrete being mixed 32 seconds in each of the mixer drums. This is at the rate of slightly more than 300 square yards an hour of completed surface, equivalent to 140 feet of 20-ft. pavement per hour on 980 feet per 7-hour day.

One of the inspectors on the job is W. C. Anderson, author of an article in our January issue. The inspection of work was made in company with B. W. Davis, Maintenance and Equipment Engineer of the North Carolina State Highway and Public Works Commission.

## Flocculation, Chemical Treatment and Flexible Filters for Sewage Treatment

**By W. E. Buell, Consulting Engineer**

The Atlantic, Iowa, sewage treatment plant will consist of sedimentation and separate sludge digestion, with provision for flocculation and single or double filtration. The plant is designed to treat sewage from a city of 10,000 population, plus corn and squash cannery wastes equivalent to 10,000 population. These canneries will operate for about three months.

During 9 months of the year, the treatment will consist of flocculation followed by primary settling and trickling filters. During the remaining 3 months, chemical precipitation will be used in addition, with either single or double filtration. The filters are so arranged that No. 1 Filter takes the load from the primary tank on Monday and No. 2 Filter takes settled sewage from the No. 1 secondary tank. On Tuesday, No. 2 Filter takes the primary load and No. 1 Filter takes the settled sewage from the No. 2 secondary tank. Filters can operate in series or in parallel as desired. The filters will be provided with air vents, running horizontally, 4 feet below the top of the stone and 4 feet above the underdrains, the filters being 8 ft. deep.

# The Editor's Page

## Refuse Collection and Disposal: a Grossly Neglected Municipal Service

IS IT not time that American Cities became refuse conscious? The dirty streets of fifty years ago are no longer tolerated by cities with any local pride. The disgusting evidences of sewage pollution in our rivers are rapidly disappearing and the unsightly and malodorous sewage treatment plants of twenty years ago are being replaced with attractive buildings in landscaped parks to which citizens "point with pride."

But what pride can most of our cities take in their methods of handling garbage, ashes and rubbish? Through every street of the city pass the vehicles that collect the refuse, and fortunate (or rather, commendable) are the cities in which their passing is not made evident by the sight and odor of the garbage, by dust from the rubbish and ashes, papers blown from the carts, and drippings of garbage liquor. Even more obnoxious is the too-common dump which receives the refuse, and which exists in more cities than many realize. There are few more disgusting sights than a view of the dump on the outskirts of a city, perhaps disfiguring the bank and polluting the water of a river that should be an asset to the city as an attractive beauty spot. Odors from garbage being stewed in the burning rubbish, smoke from this and dust from ashes being dumped, and rats, pigs, dogs and swarms of flies—it seems almost incredible that any city with a particle of pride would permit such a condition to exist anywhere within its boundaries. But hundreds do.

Why do such conditions continue to exist, with little improvement, year after year? Not because there is no remedy; incinerators are obtainable which will convert all the refuse to inorganic ash without creating appreciable smoke or odor, and equipment that will largely or wholly eliminate collection nuisance.

It would seem as though the fundamental reason must be that most of our cities are not yet refuse conscious. They have for many years been accustomed to the unpleasant conditions referred to, accepting them as unavoidable; as they once did muddy roads and dirty streets, outdoor privies, turbid drinking water, dimly lit streets. Now we have millions of miles of paved streets and roads, tens of thousands of miles of sewers, thousands of sewage treatment plants and of water purification plants and practically all of our streets are well, many of them brilliantly, lighted.

These all cost money. But we doubt if there is a single city that would even suggest going back to the old condition in order to save the necessary cost of these improvements, or a community, however small, that is not looking forward to the time when it can have them all. And we do not doubt that, once a city installed improved, modern refuse collection and disposal methods —the cost of which would be very much less than that of any of the other improvements mentioned—the citizens would be equally averse to giving them up.

Of all municipal services rendered to the citizens, none is more intimate, prominent and frequent than the calls, several times a week, of the refuse collecting vehicles at every residence and their passage through every street. It would seem, therefore, as though the municipal official has no better and easier opportunity for winning approval of the voters than to improve this service. And there are few communities where there is not noticeable opportunity for bettering both methods and equipment.

As to the latter, a number of manufacturers now offer collection trucks that are a great improvement over the makeshifts of a few years ago. They are watertight, most of them dust-tight, easier to load and to dump, of any desired capacity, comparatively noiseless, readily handled in alleys and narrow streets, with low and high travelling speeds for collecting and transporting respectively; while different makes have other individual advantages. Undoubtedly further improvements are possible, but they can be developed only by trial in actual service of the best now available; and only if manufacturers receive, in the form of purchases of the best now available, a measure of guarantee that there will be a market for better if and when developed.

If communities throughout the country will display an active interest in this matter of refuse collection and disposal at all commensurate with its importance to themselves and to that which they recently have given to sewage disposal, we know that manufacturers can and will gladly and helpfully cooperate with them in improving their service, and even in developing today's best into tomorrow's better.

During the past few months PUBLIC WORKS has received replies from more than two thousand municipalities to questionnaires dealing with the collection and disposal of their refuse. Tabulations and summaries of this information are given elsewhere in this issue, and we believe that a study of them will show that they substantiate the above criticism of present practices and confirm our belief that a reform in them is long overdue; especially in view of the probability that conditions among those who did not reply are less creditable than among those who did.

We hope this information may also serve the additional purpose of furnishing data that will aid in the development of greatly improved methods, and that municipal officials, engineers and equipment manufacturers will cooperate earnestly to attain this end.

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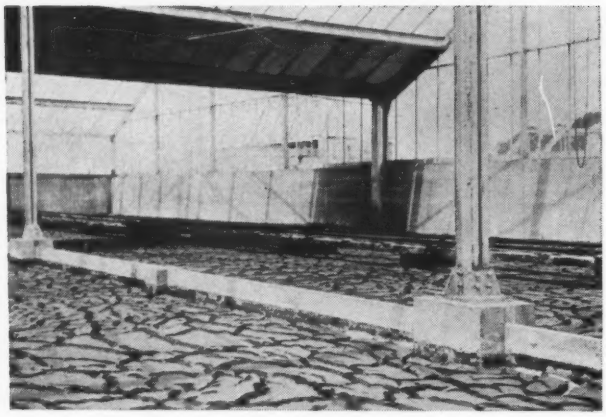
## Highway System Produces Amazing Tax Income

In 1939 motorists paid to the various states, exclusive of the Federal Government, $816,433,000 in gasoline taxes. To illustrate changing conditions in taxation, and the role of the highway system as a revenue producer, it is of interest to note that the entire tax revenue of all of the 48 states back in 1922—17 years previous—amounted to $727,119,000. In other words, gasoline taxes paid to the states last year were greater than the total amount of revenue collected from all sources by the states in 1922 or any previous year.



Typical air dried sludge on the bed.

# The Use of Sewage

LeROY W. VAN KLEECK
Senior Sanitary Engineer, Connecticut State Department of Health

IT IS the purpose of this article to discuss briefly the fertilizing value of various sewage sludges, principally so-called primary digested sludge, and to give instructions on its use as a soil conditioner.

When raw primary sludge as first settled in tanks is stored under controlled conditions in special tanks (either heated or unheated) for considerable periods, it is called digested. The digestion of sludge involves a bio-chemical process in which the organic matter remaining in the sludge is in a more stable form. Whereas raw sludge is generally dark brown in color, lumpy, watery, and has an offensive fecal odor, digested sludge is black in color, homogeneous, has the consistency of thinned molasses, and gives off a tarry or gassy odor which is not offensive. For reasons stated below digested primary sludge is by far the safer and preferable type to use as fertilizer.

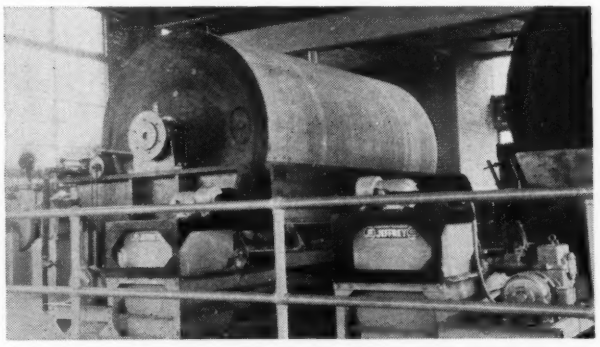
Liquid sludge contains from 85 to 98 per cent water; it is rarely used as a fertilizer whether raw or digested. Principal objections are, first, the large quantity of fluid bulk that must be transported; secondly, the difficulties of application to the area to be fertilized; and, thirdly, the greater likelihood of objectionable odor. Instead, sludge is generally utilized following partial dewatering by draining it on beds of sand, pressing, centrifuging or vacuum filtration. The partially dried sludge is then referred to as "sludge cake," and ordinarily contains 70% or less of moisture. Such cake is dry enough to be shoveled and spread like manure or moist soil.

The use of raw sludge as fertilizer has numerous objections. It is odorous, has a high grease content, tends to make soils acid, and is a potential carrier of pathogenic bacteria. Unless limited strictly to orchards or forage crops in iolated areas, it is not recommended. When used for such purposes, careful consideration should be given to its effects on the soil, since liming or other soil control methods may be necessary.

## Types of Digested Sludge

Most digested sludge is so-called primary digested sludge—that is, from sewage solids which have been settled in tanks and digested. So-called secondary or humus sludge is the sludge settled from sewage after it has been passed through stone filters, known as trickling filters. This type of sludge is frequently mixed with primary sludge and digested with it.

Activated sludge is a special type of sludge produced by the agitation of sewage in the presence of air. Raw activated sludge has special properties, including a much higher fertilizing value than ordinary primary or secondary sludge. Digestion, however, destroys much of this extra fertilizing value. When raw activated sludge is heat-dried and ground, it is a true competitor with established organic fertilizers. The drying process generally frees such sludge of harmful bacteria. Only large activated sludge plants can profitably install the necessary drying and grinding equipment to produce such sludge. Milwaukee produces and sells such a sludge under a trade name.



Vacuum filter at Hartford producing cake from elutriated sludge.

## Chemical Analyses of Sludges and Related Materials

A comparison of sludge with other common fertilizers is afforded in the table below:

### Typical Chemical Analyses of Sludge, Manures, and Commercial Fertilizers (Dry Basis)

| *Substance* | *Total Nitrogen % (Dry Basis)* | *Total Phosphoric Acid % (Dry Basis)* | *Total Potash % (Dry Basis)* |
|---|---|---|---|
| Digested sludge* (Average of samples from a number of sewage plants in Connecticut) ..... | 1.7** | 1.5 | 0.15 |
| Partially digested, activated sludge from a Connecticut plant ..... | 2.6** | 1.9 | 0.12 |
| Manure† (Supposedly a mixture of animal wastes) | 1.97 | 1.29 | 1.96 |
| Horse manure‡ .. | 0.7 | 0.11 | 0.45 |
| Sheep manure‡ .. | 1.8 | 1.25 | 3.0 |
| Commercial potato fertilizer ..... | 5.0 | 8.0 | 7.0 |

* Some sludge cake produced in Connecticut also contains about 10% calcium oxide (lime). This is generally of direct benefit to most soils and crops.

** The availability of this nitrogen is less than of the manures.

† As reported by E. E. DeTurk Sewage Works Journal, July, 1935, pp. 597.

‡ As reported by T. P. Maloy, Sewage Works Journal, July, 1931, pp. 485.

# Sludge as Fertilizer and Soil Conditioner

**Data on fertilizing value of sludges of various types, and instructions for use; analyses; amounts to be used.**

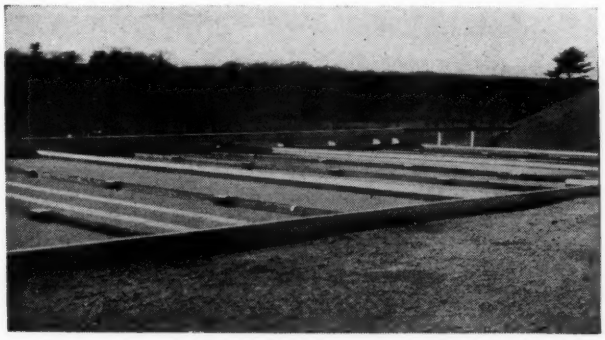
## Using Digested Sludge as Fertilizer

Among the reasons why sludge is not more commonly used as a fertilizer are the following: Many fear that sludge will produce offensive odors, though the odor from well-digested sludge is less offensive than from most fresh manures. Some have an aesthetic dislike to its use because of its source, or a lack of appreciation of the humus value of sludge and of the great need of most soils for such humus. Many sewage plant superintendents and supervising officials fail to promote the use of sludge by the public. The lumpy or chunky physical form of much sludge cake also detracts from its utilization. Heat drying and mechanical grinding or even grinding alone produces a product which is much more suitable for use. Finally, there is a lack of knowledge on the proper application of sludge; its limitations, and the types of vegetation for which it is adapted.

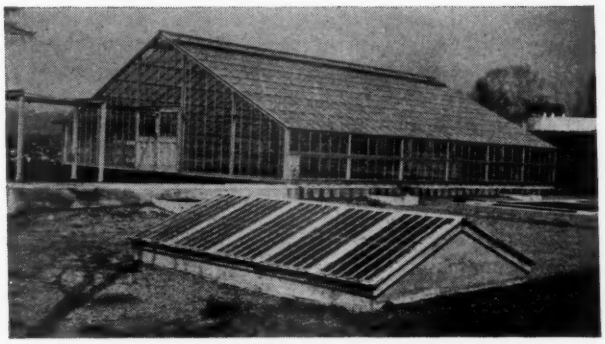
## Interpretation of Chemical Analyses

It will be noted that sludge compares favorably with the ordinary run of manures. Its principal deficiency is in potash. The nitrogen in sludge has been shown to be available over a long period (generally at least two years) and there is, therefore, no danger of so-called burning of crops.

The chemical analysis of sludge does not, however, tell the entire story. Primary digested sludge has its greatest use as a soil conditioner, constituting as it does a valuable source of humus. Generally, about 50% of the dry weight of sludge is humus. A sandy soil is particularly benefited by sludge, since its water holding capacity is increased. Sludge is not a balanced food for plants as commercial fertilizers are, and cannot be expected to serve as an all-purpose plant food. Its application, however, works a mechanical change into soil, which improves its texture. The exclusive use of commercial fertilizers represents unsound and dangerous farming practice. Soils repeatedly planted to growing crops require the organic humus present in manures, peat moss, green cover crops, and sludges.



Typical uncovered drying bed.



Covered sludge bed. Small bed in foreground for skimmings.

Another significant point not obvious in the chemical analysis of digested sludges is the comparative freedom of such sludges from weed seeds which are largely destroyed in the digestion process. Most manures on the other hand contain numbers of weed seeds which prove very objectionable, particularly when they are spread on lawns. Tomato plants and a few of the cucurbits will sprout in sludge, but they are not ordinarily troublesome.

## Methods of Applying Digested Sludge and Hygienic Considerations

Sludge may be applied as a top dressing in the case of trees or lawns; in the hill in the case of melons, squash, or other vine crops; or spread, then plowed or forked into the soil. When used as a top dressing, it should not be applied too thickly, especially on lawns or it may choke the growing vegetation. Recommended amounts are listed hereafter. Sludge may be applied when the ground is frozen or covered with snow. In such cases it is raked and pulverized into the soil in the spring. Grinding sludge cake with machines, or breaking it into smaller particles by hand, greatly enhances its application as a top dressing. Except where applied to grass, trees, shrubs, or perennial beds, sludge should be placed in the hill or plowed under in the fall or early spring before planting the crop.

Digested sludge is safe from the health standpoint if mixed with the soil and no more is applied to the growing crop. It is safer not to plant root crops eaten raw (examples: carrot or radish) or vegetables grown in close contact with the soil and eaten raw (examples:

lettuce, celery, onions) in ground recently fertilized with sewage sludge.

The digestion of sludge, together with the commoner methods of dewatering such as air-drying or vacuum filtration (in which case most sludges are conditioned with lime, giving a high enough pH to kill great numbers of bacteria), and its storage afford sufficient protection against intestinal diseases. It is also desirable of course to use reasonable care in handling it. A special committee of the Federation of Sewage Works Associations reporting on the "Utilization of Sludge as a Fertilizer" in the Sewage Works Journal for November, 1937, states: "The committee knows of no case of sickness traceable to the use of digested sludge or activated sludge."

## Amount of Digested Sludge to Use

While an excess of sludge will rarely do harm, except in cases of outright mechanical smothering of growing things, the following suggestions for its application have been made by various investigators:

| | |
|---|---|
| 1. For orchards* | 10 tons wet sludge cake per acre (or about 11 cu. yds. per acre) |
| 2. For grass** | 10-20 cu. yds. per acre (or 0.6 to 1¼ cu. ft. per 100 sq. ft. of soil) |
| 3. For vegetables, shrubs and flowers.** | 20-60 cu. yds. per acre (or 1¼ to 3¾ cu. ft. per sq. ft. of soil) |

* John F. Skinner, Sewage Works Journal, March, 1932, "Sludge as Fertilizer."

** Committee Report, Federation of Sewage Works Associations, Sewage Works Journal, November, 1937.

## Fortifying Digested Sludge

Fortifying sludge with chemicals will increase its total food constituents and hence its value. Fortified sludge should be applied in smaller amounts to the soil depending on the type of crop and the local conditions. The following formula is suggested for general use and is suitable for almost any crop or soil:

| | |
|---|---|
| Sludge (dry basis) | 360 lbs.* |
| Ammonium sulphate | 25 lbs. |
| Acid phosphate (20%) | 50 lbs. |
| Muriate of potash | 15 lbs. |

* Amounts to about 900 lbs. of sludge cake as removed from the average sand drying bed or 1,200 lbs. of cake as removed from the average vacuum filter. Roughly 2/3 of a cu. yd. or about 20 cu. ft. Other formulas may be used for special cases or a particular soil.

## Use of Sludge as Fertilizer

Some of the uses of sludge have already been pointed out. Its use is particularly adapted to lawns, golf courses, pastures and meadows. The home owner may well use it for the flower and vegetable garden. T. P. Maloy[1] reports its beneficial effects on trees. He states that trees fertilized with sludge had a healthier foliage, both in amount and color, and retained their leaves for a longer time in the fall than nearby unfertilized trees.

Sludge deepens the green color of grass and stimulates a luxurious growth. Its benefits seem noticeable for several years. For flower beds it provides a much needed humus for the hot summer months as well as supplying a moderate but long-yielding amount of nitrogen. In vegetable gardens, it has been found to be particularly beneficial for corn, potatoes, beans, spinach, asparagus and vine crops.

The writer has for years grown plots of vegetables, flowers and grass with and without sludge. Its worthiness as a soil conditioner has been demonstrated by excellent plant growth and high yields.

## Economic Value of Digested Sludge

While digested primary sludge does not have the economic value of raw activated sludge, or other special types of sludges, it does have an economic value (based primarily on its chemical analysis and without regard to its valuable humus contents) of at least 50 cents per cu. yd. Some sewage plants in the United States are charging from 25 cents to $2.00 per cu. yd. for unground sludge. Ground sludge brings a better price and is generally in demand. At many sewage plants, sludge may be had for the asking, and it is an economic waste when such a sludge must be used for fill. The potential promoter or user of sludge should weigh the cost of manure in his community as a rough indice of the value of local sludge.

Digested sludge is certainly worth reasonable hauls of say five miles, if obtainable at small cost or no cost. Sludge may be transported in truck bodies or bagged for hauling in smaller amounts by private car.

1 Sludge as Fertilizer, Sewage Works Journal, July, 1931.

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# Leaks and Water Waste — Comments on Article in April Issue

I believe that this article should also cover the importance of good meters in helping to curtail the waste of water by showing up leaks in the plumbing and fixtures after going through the meter. This is a very important item even after the main line leaks are all taken care of. I might mention that a sensitive meter with large sweep hand will usually detect any leaks in plumbing if all taps are closed and the large center hand still operates. This is a very neat way to convince the customer that he is paying for water not used and will stop a lot of waste.—*P. R. Carlon, Engineering Dept., Pittsburgh Equitable Meter Co.*

Although the article mentions the necessity of a sufficient number of valves, their importance might be stressed. We often find that valves are so sparsely distributed they cannot be found. This is especially true during the winter months when streets and boulevards are covered with snow and ice. Just the other day a water works superintendent said they lost about 100,000 gallons of water because they did not have a gate valve on the lead to a hydrant which was broken.

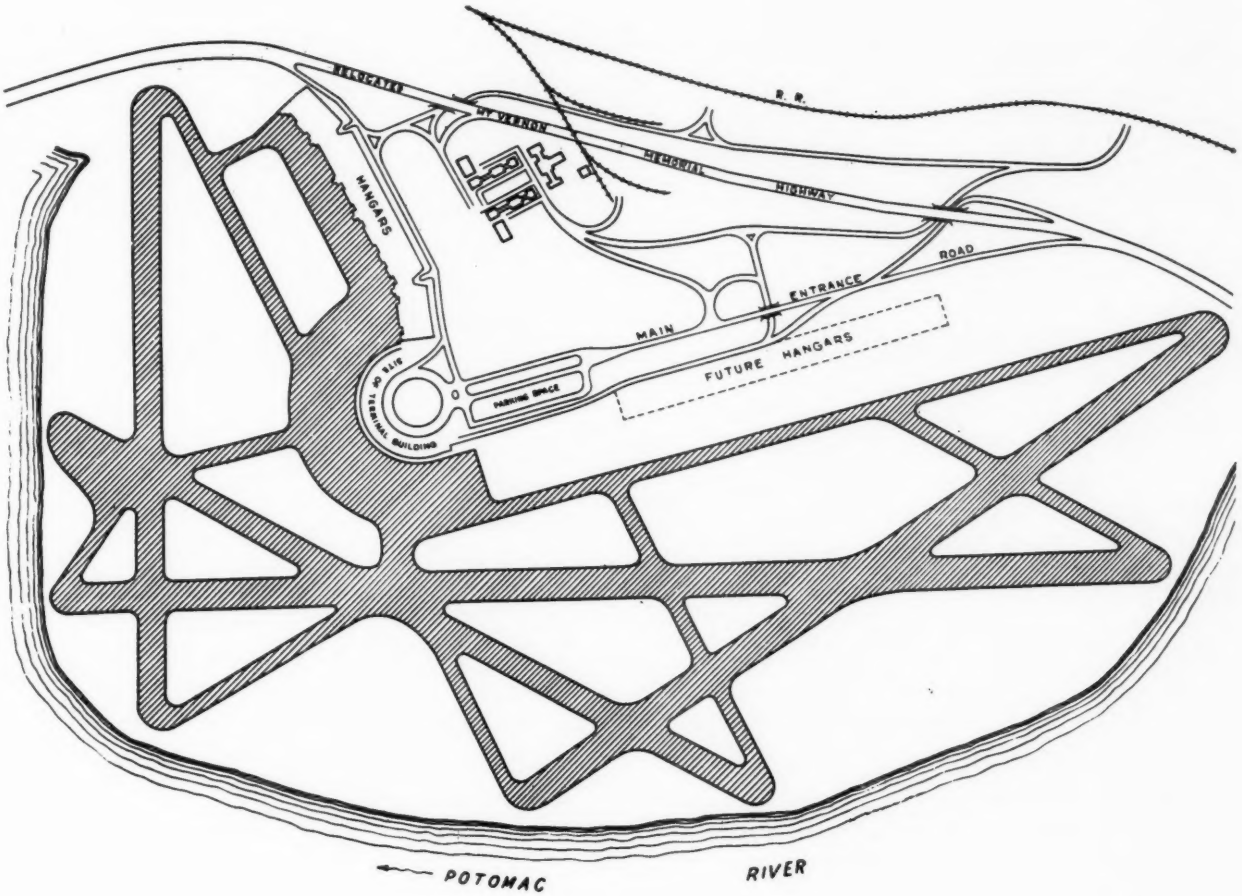
Our most frequent sources of leaks seem to be the service connections. These leaks are more prevalent during the spring and fall months during freeze-up and thaw-out periods. Although the pipes are laid below frost level, there seems to be enough movement to cause the service connection to leak.

We like the simple language used in this article, because the most frequent comment we have from our local operators is that most magazine articles are too deep for them to understand. Of course, most of our water and sewerage systems in the state are relatively small.—*Lloyd K. Clark, Director, Division of Engineering, N. D.*

It might be of interest to you to know that we (in Hartford) make a survey covering our entire system each year, dividing it into about fifty subdivisions in which we take 24-hour consumption runs and subdivide any divisions which show an appreciable increase in consumption over the previous years. In this way we think we have our system under pretty good control. Incidentally, this work is under my supervision.—*F. S. Brainard, President, F. S. Brainard Co.*

Assuming an area of 5 square blocks, a crew equipped with a modern leak detector can, in twenty-four hours, survey every service, every hydrant, every valve and turn in an exact report, which will make possible the location of practically every leak in this area. No excavations are necessary; and no one in this area will have his supply of water turned off for a period of time.—*F. R. Gibb, Water Leak Detector Co.*

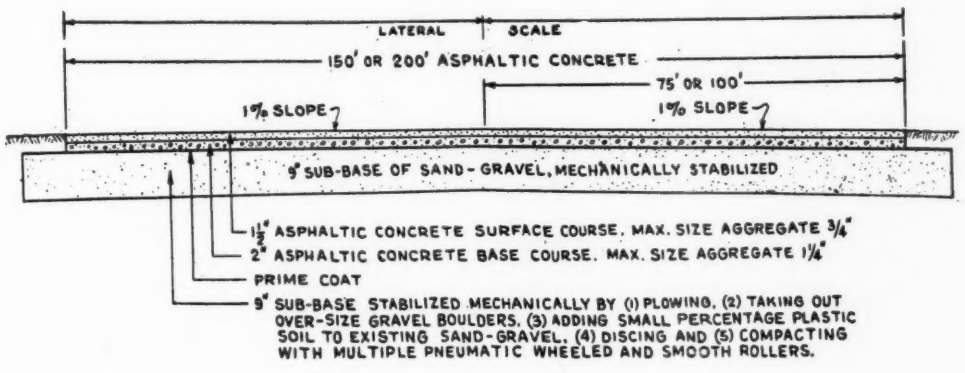
# Washington National Airport

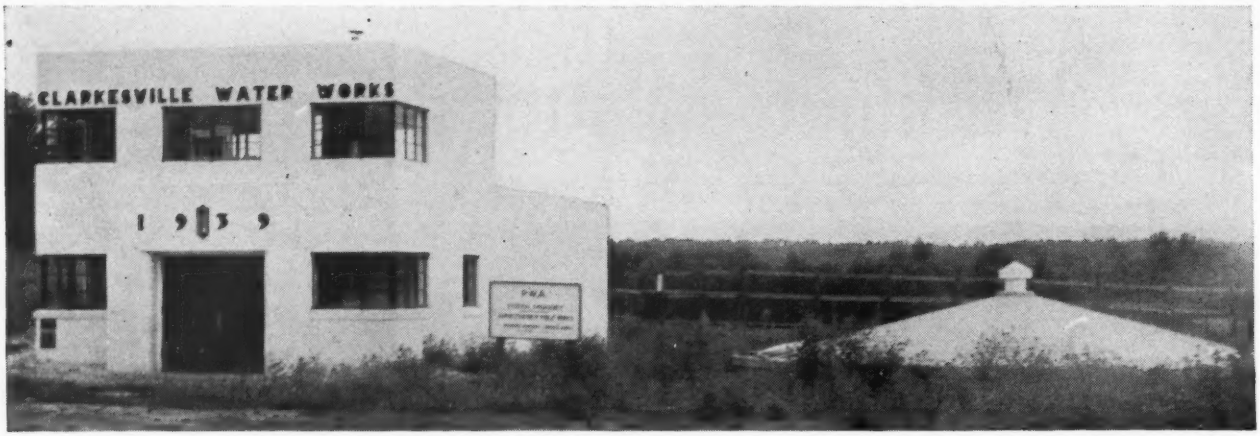



THE layout above shows the asphalt runways and taxiways of the Washington National Airport at Gravelly Run, Va., about two miles south of the Washington Monument. The runway lengths North and South are 6,875 ft.; east and west, 4,200 ft.; northwest and southeast, 5,300 ft.; and northeast and southwest, 4,882 ft. The north-south and northwest-northeast runways are 200 ft. wide, paved, with 150-ft. gravel shoulders on each side; the east-west and northeast-southwest runways are 150 feet wide, paved, with 175-ft. gravel shoulders on each side.

A typical cross-section of the asphalt runways is shown herewith. The hot-laid asphaltic concrete contained 5% to 7% of 120/150 penetration asphalt cement in the base and 6% to 9% in the surface. The maximum mixing temperature was 325°F. Mixtures contain uncrushed aggregates, except 15% in the surface course.

Locally available sand and gravel were used throughout (bid price $2.11 per ton) for processing, sizing and crushing gravel, also for furnishing asphalt, mixing, placing and compacting. The compacted asphalt mixes are estimated to weigh 110 pounds per inch of depth per square yard. About 1,000 tons of asphalt mix were produced per day. The stabilized subbase was constructed with government forces at an estimated cost of 30 cents per sq. yd., including prime coat and fine grading. The bid price on the base and surface was 40 cents per square yard, exclusive of grading, engineering, etc.






The modern operating building of the Clarkesville, Ga., plant

# Modern Filter Plant Treats 100 Gals. Per Minute

## Small plant for a community of 617 gives complete treatment

WITH a capacity of 100 gallons per minute, a new modern water filter plant has been completed at Clarkesville, Ga., population 617 (1930), to treat water from the Soque River. This is one of the recent small filtration plants constructed in Georgia where all of the 82 surface supplies receive filtration.

The water is taken from the Soque River through an 8-inch cast iron line to a circular pump house, 8 ft. 4 inches in diameter. This pump building is of such height (19 ft.) that while the pumps are at all times below river surface elevation, the operating floor is above high water. From the pump the water is passed through orifice actuated mercury gauges to the mixing or flocculating channel. Alum and lime are added as the water enters the flocculator by means of an Omega dry feeder for the alum and an International lime solution feeder with a split feed for both pre- and post-treatment, if this is desired. Post-treatment is ordinarily needed to provide a non-corrosive water.

The flocculator is of the usual over and under baffle type, 27 feet long, 2′ 0″ wide and with a gross total depth of 10 feet 9 inches at the the outlet. The bottoms of alternate baffles are 8 inches off the floor of the flocculating channel. Baffles are of wood, spaced as follows, from the inlet end: 26 baffles at 3 13/16 inches centers; 15 baffles at 5 13/16 inches centers; and 9 baffles at 8 13/16 inches centers. Retention period in the flocculating channel is about 30 minutes.

The distribution of the water from the flocculating channel uniformly and smoothly to the settling basin is accomplished by an ingenious device. The discharge from the flocculating channel is into a stilling channel which extends across one end of the settling basin, with the bottom of the stilling channel at about mid-depth of the settling basin. The bottom of the channel consists of pre-cast concrete blocks which are so arranged that the flocculated water flows past the sides and over the end of the blocks, which are adjustable to such positions and openings as operating experiences indicate are most effective in obtaining an even distribution of the water over the entire end of the settling basin.

The coagulation basin is 27′ 0″ long, 18′ 4″ wide and 10 feet deep, providing a detention period of about 6 hours. The takeoff to the filter from the settling basin is by a weir into an outlet trough which feeds through a pipe to the filter.

The single filter is 8′ 6″ long and 6 feet wide with a single wash water trough in the center, the lip of the trough being placed 27 inches above the sand surface. The underdrain system consists of a concrete manifold or distributor with 2-inch streamlined copper laterals, spaced 6 inches on centers. Over the underdrains are 18 inches of gravel and 27 inches of sand.

From the filter the water passes to a circular covered clear well, 30 feet in diameter and 10 feet deep, from which the water is pumped to the distribution system and to a 50,000-gallon standpipe which floats on the line. Daily consumption is about 42,000 gallons, which permits operation 5 to 9 hours per day, averaging about 7½ hours. The standpipe carries sufficient water to permit this one-shift operation.

The filtered water is chlorinated by means of a Wallace & Tiernan equiscale chlorinator Type MSE.

The raw water varies greatly in turbidity, ranging up to 800 ppm or more during heavy rainfall periods. Typical analyses of the raw and filtered water during the past few months show the following:

| | *Raw* | *Filtered* |
|---|---|---|
| pH | 6.6 - 6.8 | 8.2 |
| Alkalinity | 10 ppm | 25 ppm |
| Turbidity | 45 to 800 ppm | less than 5ppm |
| $CO_2$ | 5 ppm | — |

The Clarkesville plant was designed by and constructed under the supervision of the J. B. McCrary Co., Consulting Engineers, Atlanta, Ga. Dr. D. B. Jackson is mayor of Clarkesville and O. G. Allen is Superintendent of Water Works and Plant Operator.

Mr. Wickesberg inspecting spalling at a street intersection.

# Pavement Spalling Causes and a Suggested Remedy

By A. W. WICKESBERG

City Engineer, Appleton, Wisc.

**Modern ice control methods, necessary for safe traffic, create a new problem for which a remedy is suggested.**

THE extensive and ever-growing snow removal and ice-prevention program of the modern municipality is giving the municipal engineer a problem that was not anticipated—serious spalling of new concrete pavements.

In the carefree days when the public took the snow as it came from the skies and liked it, the city pavements were generally covered for months at a time and little thought was given to them until spring. Under a protective covering of snow and ice, the pavement went through only a few cycles of freezing and thawing in the entire winter, with the result that spalling was unheard of.

With the continued public demand for more rapid, more complete, and more reliable snow removal schedules, pavement surfaces are being required to withstand an entirely new onslaught—a large series of freezing and thawing cycles per season.

The fact that old concrete pavements, even those that are weak and badly cracked, are not spalling, while new ones certainly are, despite the fact that the quality of concrete construction has progressively increased, suggests that concrete pavements are vulnerable to this attack only in the first few years of their life, and that if some protection could be afforded in the early life of the pavement, the problem could be met.

In my opinion, the spalling of concrete pavements is due to the many cycles of freezing and thawing that accompanies ice-control. Spalling or peeling, such as is shown in the accompanying photographs, occurs most extensively at intersections where normally greater ice-control must be directed. In our city, as in any other northern municipality, applications of abrasives mixed with chemicals must be spread on the streets several times a week throughout the winter. We have debated the relative merits of calcium chloride and sodium chloride as admixtures with cinders or sand for this purpose. In this discussion I will not go into the relative merits of the two salts insofar as their efficacy in de-icing is concerned.

Were no chemicals added, the pavement surface would remain in a frozen condition for days and maybe weeks at a stretch. With the addition of the chem-

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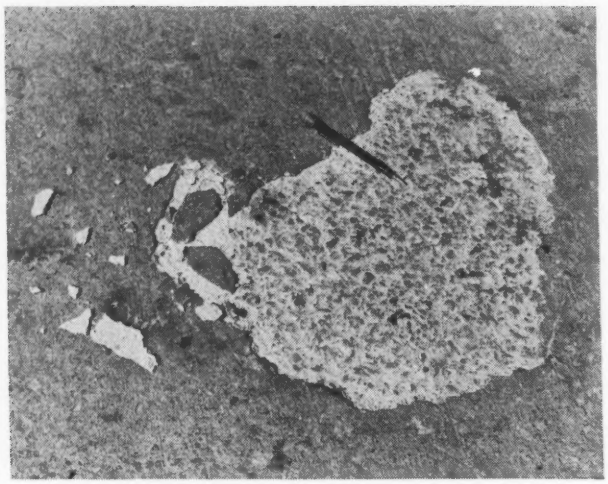
# INTERNATIONAL Industrial Power



Typical scaling on a new pavement

ically-treated abrasives, however, during a normal winter day the ice on the pavement melts even though the air temperature may not exceed 20 degrees F. This cold solution rests on the pavement until diluted, or until nightfall, when the temperature may lower enough to re-freeze the solution. Then the process is repeated. The hours of the ice-control gang are about the same as those of the milk-man.

We have all observed laboratory tests of concrete specimens subjected to freezing and thawing cycles. Pavement intersections are excellent field specimens to observe.

It occurs to one that possibly the simple crystallization of the salts used in ice-control may cause disruptive forces in the minute pores and cracks of the concrete pavement. Neither sodium chloride nor calcium chloride has a chemical effect per se on concrete surfaces. The effects that one observes are entirely physical as outlined above.

The solution to this problem obviously does not consist in lessening ice-control measures simply to protect the concrete surface. A safe, skid-proof street is more important than any amount of spalling, for human safety cannot be neglected. Therefore efforts should be made to prevent spalling; and these should be made during construction of the pavement and immediately thereafter.

First of all, during construction, the objective must be quality concrete. The well-known factors of cement content per cubic yard, water-cement ratio, consistency, and proper placing demand careful attention. Most important of all are the two final phases—finishing and curing. The abominable practice of over-finishing to the extent that a weak, chalky layer of laitance is formed on the surface must not be permitted. Further, the concrete pavement should not be permitted to dry during the first two weeks of its life. Proper curing is a relatively cheap way of securing durable concrete, and its neglect is inexcusable.

It is our intention, in future paving work in this city, to spray the concrete pavement surfaces with a protective coating of linseed oil right after the curing period, before traffic is permitted on the street. The process will consist of spraying two applications with an ordinary air sprayer such as we use for making traffic lanes. The first application will consist of one gallon of boiled linseed oil to one gallon of turpentine, sprayed at the rate of about .02 gallon per square yard. The second coat will be applied after the first has penetrated the pavement and been absorbed by it, and will consist of a mixture of 2 gallons of linseed

oil to one gallon of turpentine, applied at a rate of .03 gallon per square yard. This treatment will be applied only at intersections and slopes that will be subjected to de-icing materials. One application has been found to be sufficient for the life of the street. Apparently the first few years of service that a concrete pavement receives are the most critical. As time goes on it receives an armor coating of oil drippings and what not that fill all the pores. As stated above, old pavements laid before the present de-icing programs were developed have not spalled under the process.

A few of our crossings have deteriorated so badly that we have been forced to apply a bituminous seal coat over the most severely attacked areas. This method, of course, is more expensive and the appearance of the street is marred. Here again, a program of prevention is cheapest in the long run.

## Snow Drift Control by Highway Design Methods

A review of the work being done in the various States, as compiled by Professor E. A. Finney and reported in Bulletin No. 86, Engineering Experiment Station, Michigan State College (Highway Research Abstracts, April 1940), shows definitely that highway design methods can be employed effectively to reduce snow drifting on the highways. Present trends toward wider rights-of-way, higher grades, lower excavation prices, and increased roadside development have simplified the problem of incorporating good snow control features into the original design. Such features include raising the grade line above adjacent ground level, special treatment of cut sections, adoption of wide shoulders, flat backslope and shallow ditches, use of vertical curves at the tops and bottoms of slopes and the elimination of guard rails where possible. A snow drift study is included in many States as part of the preliminary survey for new construction.

The proper height to which the grade line should be raised above the adjacent ground level is generally considered to be equal to or greater than the average depth of snowfall in that area. This height will therefore vary from 18 in. to 5 ft. In designing new highways or the relocation of existing routes, the following practices are generally considered. In rolling country, the lee slopes are avoided and high ground and windward slopes used wherever possible. On narrow rights-of-way deep cuts are avoided if at all possible, especially when the road is at right angles to the direction of the prevailing winds. The highway location is usually selected through sheltered areas such as would be found in valleys or wooded sections. Farm buildings or other similar structures are avoided or moved far enough from the traveled way so that their influence area will not cause drifting on the highway.

Shoulders, ditches and backslopes are being designed to provide ample storage space for snow plow deposits and drifts which may form from wind-borne snow. A shoulder width of 8 ft. is considered standard practice in many States, although 11 ft. is often used especially when guard rail is to be eliminated on a high fill section. Ditches are either of the shallow valley type or the V type, the ditch line usually being 15 ft. or more from the edge of the roadway. Back slopes are as flat as can be practically obtained. For snow storage design in shallow cut sections the backslope should not be steeper than 1 on 4, although the ideal slope is 1 on 6. In deep cut sections, it is a common practice to borrow fill material from each side,

thus creating a storage space for snow deposits. Some States make it a standard practice to widen all cut sections at least 10 to 15 ft. to provide snow storage.

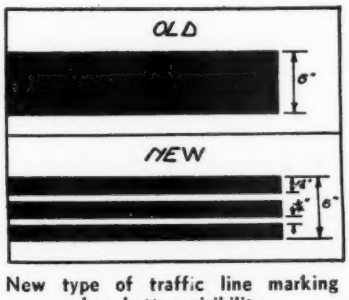
Rounding the top and bottom of embankment slopes greatly improves the appearance of the highway, helps eliminate soil erosion and reduces maintenance costs. It likewise aids in promoting free air-flow across the highway thus aiding in reducing drifting of snow. General practice is to specify vertical curves from 2 to 10 ft. in length for this rounding of the slopes. Wherever possible guard rail should be omitted as in areas of heavy snowfall it will limit removal operations as well as cause drifts to form on the traveled way.

Wind tunnel tests were also made on a number of model highway cross-sections to test various designs. It was found that the length of the eddy area produced on the lee side of an embankment was approximately 6.5 times the height of that embankment. This relationship varies somewhat with the slope of the windward side of the embankment, but wind velocity has no effect on the length or shape of the eddy area. Rounding the top and bottom of embankments does not change the length of the eddy area, but it does lower the height of the drift area back of the embankment. From the standpoint of minimum drifting, the face of a bank formed by a cut, as well as a fill, should have a slope no steeper than 1 on 4.

Among the many items of work to be included in an organized program of betterment work are the following: tree-trimming and brush removal, widening cut sections for snow storage and fill sections to eliminate guard rail, removal or repair of dilapidated right-of-way fences and other obstructions, and the frequent mowing of weeds and grass on the right-of-way.

## Traffic Painting in St. Louis

A few years ago when officials of St. Louis, Mo., decided to mechanize traffic painting work, they designed and built a special paint machine which has resulted in savings in labor costs and in paint used. Previously, center-line marking consisted of a single stripe which was six inches wide and painted by hand. The paint machine, instead of marking a single six-inch stripe, marks three stripes each one and one-half wide with a ¾" spacing between them.




New type of traffic line marking has better visibility

F. J. McDevitt, director of the Department of Streets and Sewers, reports that the three parallel lines give better visibility besides effecting a saving of 25 per cent in paint. More than 85 miles of center-lines are machine-painted each year. About 30 gallons of white lacquer paint are used for each mile of striping, and the cost of labor per mile ranges between $3.50 and $4.00.—American Public Works Association.

# Collection and Disposal of Refuse

*(Continued from page 11)*

bage by grinding and discharge into the sewers. These have not been investigated further, but it is probable that this method of disposal is used for only a portion of the garbage in most cases.

Feeding to hogs and the use of open dumps continue to be the major method of disposal. In a number of cases, cities use two or even more methods of disposal, so that the 1,367 cities covered by this report show a total of 1,511 "methods" of disposal. In addition to 220 using incineration and 10 using the sewers, 544, or 36.0% fed their garbage to hogs; 101 or 6.7% employed sanitary fill; 69 or 4.6% buried their garbage; 419, or 27.7% used open dumps; and 136 or 9.0% reported covered dumps. In the small communities covered by the first portion of this survey and reported in our February issue, open dumps represented 50.2% of all disposal methods reported, and hog feeding represented 31.6%.

## Size of Collection Units:

Each engineer was asked what was, in his opinion the most efficient body capacity. Where garbage and rubbish are collected separately, a larger body can be used for the latter, and our question was not so worded as to permit a differentiation here. However, of 367 replies 139 preferred bodies of less than 4 cu. yds. capacity; 84 thought 4 to 5 yd. bodies most efficient; 43, 6 to 7 yd.; 65, 8 to 10 yd.; 33, 11 to 15 yd.; and 3 over 15 yd. Of the 98, who gave truck capacities, 5 preferred 1-ton or smaller units; 70 preferred units

TOTAL AMOUNT OF GARBAGE REPORTED COLLECTED

| | | |
|---|---|---|
| Mobile, Ala. | 24,362 | Tons |
| Glendale, Ariz. | 1,040 | " |
| Anaheim, Calif. | 1,403 | " |
| Berkeley, Calif.* | 2.5 | " |
| Fullerton, Calif. | 1,200 | " |
| Glendale, Calif. | 7,445 | " |
| Pasadena, Calif. | 14,000 | " |
| San Francisco, Calif.* | 620 | " |
| Hartford, Conn. | 32,000 | C.Y. |
| Stamford, Conn. | 15,000 | Tons |
| Evanston, Ill. | 8,704 | " |
| Rockford, Ill. | 5,054 | " |
| E. Chicago, Ind. | 59,848 | C.Y. |
| Cedar Rapids, Ia. | 8,000 | Tons |
| Topeka, Kan. | 6,224 | " |
| Essexville, Mich.* | 7.5 | " |
| Flint, Mich. | 16,573 | " |
| Grand Rapids, Mich. | 15,500 | " |
| Bogota, N. J.* | 13.2 | " |
| Somerville, N. J. | 14,585 | C.Y. |
| Trenton, N. J.* | 14.2 | Tons |
| Carlsbad, N. M.* | 45 | C.Y. |
| Bronxville, N. Y. | 2,500 | Tons |
| Buffalo, N. Y.* | 500 | " |
| Newburgh, N. Y.* | 84 | C.Y. |
| Rochester, N. Y. | 35,800 | Tons |
| Syracuse, N. Y. | 23,766 | " |
| Watertown, N. Y. | 8,736 | C.Y. |
| Asheville, N. C. | 14,700 | Tons |
| Winston-Salem, N. C. | 25,000 | " |
| Rocky River, O.* | 3 | " |
| Wyoming, O.* | 1,940 | Lbs. |
| Bradford, Pa. | 6,151 | Tons |
| Erie, Pa.* | 75 | " |
| Harrisburg, Pa.* | 70 | " |
| Aberdeen, S. D. | 3,273 | C.Y. |
| Knoxville, Tenn. | 149,199 | " |
| Fort Worth, Tex.* | 200 | Tons |
| Midland, Tex.* | 13 | " |
| Front Royal, Va.* | 1 | " |
| Centralia, Wash. | 33,600 | C.Y. |
| Olympia, Wash. | 26,000 | " |
| Tacoma, Wash.* | 1.56 | Ton |
| West Allis, Wisc. | 4,200 | " |

* Per Day

AMOUNT OF MIXED REFUSE IN POUNDS PER PERSON PER YEAR

| | |
|---|---|
| Athens, Ala. (est.) | 265 |
| Berkeley, Calif. | 498 |
| Palo Alto, Calif. | 840 |
| San Francisco, Calif.(1.3)** | 403 |
| Clearwater, Fla. | 110 |
| Miami Beach, Fla. | 1400 |
| Danville, Ill.(0.5)** | 155 |
| Rock Island, Ill. | 400 |
| East Chicago, Ind. | 500 |
| New Bedford, Mass. | 372 |
| Virginia, Minn.(5)** | 1560 |
| Jackson, Miss. | 626 |
| Englewood, N. J. | 1015 |
| Kearny, N. J. | 1000 |
| Montclair, N. J. | 1059 |
| Garden City, N. Y. | 944 |
| New York, N. Y.(3)** | 930 |
| Scarsdale, N. Y. | 800 |
| Syracuse, N. Y. | 1200 |
| Gastonia, N. C.(2.76)** | 855 |
| Findlay, O.(0.53)** | 164 |
| Hamilton, O. | 410 |
| Mansfield, O. | 662 |
| Wyoming, O. | 1940 |
| Charleston, S. C. | 1000 |
| Laredo, Tex.($\frac{2}{3}$)** | 232 |
| Danville, Va.(2)** | 620 |
| Greendale, Wisc.(1.3)** | 403 |
| Kenosha, Wisc. | 892 |

AMOUNT OF MIXED REFUSE BY VOLUME (CUBIC YARD) PER PERSON PER YEAR

| | |
|---|---|
| Cicero, Ill. | 1.26 |
| Waukegan, Ill. | 1.00 |
| Hammond, Ind. | 1.25 |
| Lexington, Ky. | 6.9 |
| Havre, Mont. | 2.00 |
| Endicott, N. Y. | 2.38 |
| Tarrytown, N. Y. | 2.0 |
| Knoxville, Tenn. | 1.2 |
| Wenatchee, Wash. | 4.0 |
| Yakima, Wash. | 3.9 |

** Pounds Per Day

Tables IV, Va and Vb


Morse Boulger Destructor at Canajoharie, N. Y.

between 1 and 2 tons; 10, 2½ to 3 ton; and 13 larger than 3-ton.

## Comments from Our Readers:

Beginning March 1, the city of Merced, Calif., G. E. Winton, City Engineer, took over the responsibility for garbage collection. Collections will be made weekly in the residential portions of the city; industrial and commercial collections will be made according to demand. The charge of 50 cents includes both garbage and rubbish. The city has purchased a Gar Wood closed 12-yd. unit for garbage and one open steel body. In Oakland, Calif., Walter N. Frickstad, Sup't. of Streets and City Engineer, dry garbage is disposed of at sea, but wet garbage is used to feed hogs. All wet garbage bodies have metal covers.

WEIGHT PER CUBIC YARD OF GARBAGE OR MIXED WASTE IN POUNDS

| | | | |
|---|---|---|---|
| Homewood, Ala. | 1200 | Lansing, Mich. | 1000 |
| Little Rock, Ark. | 1200 | Lincoln Park, Mich. | 800 |
| Berkeley, Calif. | 500 | Muskegon, Mich. | 3000 |
| Burbank, Calif. | 1000 | Pontiac, Mich. | 330 |
| Fresno, Calif. | 450 | Jackson, Miss. | 234 |
| Glendale, Calif. | 1300 | Fallon, Nev. | 666 |
| Long Beach, Calif. | 1000 | Bogota, N. J. | 275 |
| Los Angeles, Calif. | 1045 | Garfield, N. J. | 500 |
| Newport Beach, Calif. | 1450 | Kearny, N. J. | 900 |
| Pasadena, Calif. | 1100 | Montclair, N. J. | 415 |
| Pomona, Calif. | 1200 | Somerville, N. J. | 1500 |
| Redlands, Calif. | 1050 | Bronxville, N. Y. | 350 |
| San Diego, Calif. | 900 | Buffalo, N. Y. | 1000 |
| San Francisco, Calif. | 800 | Rochester, N. Y. | 1800 |
| Santa Ana, Calif. | 800 | Schenectady, N. Y. | 1000 |
| South Gate, Calif. | 1300 | Sea Cliff, N. Y. | 900 |
| Stamford, Conn. | 500 | Syracuse, N. Y. | 1200 |
| Wilmington, Del. | 350 | New York, N. Y. | 600 |
| Washington, D. C. | 1000 | Cincinnati, Ohio. | 425 |
| Miami Beach, Fla. | 580 | Dayton, Ohio. | 1275 |
| Tallahassee, Fla. | 500 | Findlay, Ohio. | 1200 |
| LaGrange, Ga. | 1600 | Mansfield, Ohio. | 700 |
| Chicago, Ill. | 472 | Toledo, Ohio. | 444 |
| Danville, Ill. | 925 | Wyoming, Ohio. | 1250 |
| Hinsdale, Ill. | 1200 | Elizabeth, Pa. | 400 |
| LaGrange, Ill. | 1600 | Erie, Pa. | 290 |
| Rockford, Ill. | 1100 | Haverford Twp., Pa. | 1000 |
| Oak Park, Ill. | 600 | Philadelphia, Pa. | 1100 |
| Rock Island, Ill. | 1000 | Sayre, Pa. | 675 |
| Waukegan, Ill. | 600 | Shippensburg, Pa. | 1000 |
| Winnetka, Ill. | 600 | Spring City, Pa. | 150 |
| East Chicago, Ind. | 500 | Charleston, S. C. | 800 |
| Clinton, Ia. | 667 | Austin, Tex. | 250 |
| Davenport, Ia. | 2000 | Fort Worth, Tex. | 400 |
| Des Moines, Ia. | 700 | Houston, Tex. | 430 |
| Winfield, Kan. | 250 | Clifton Forge, Va. | 600 |
| New Orleans, La. | 472 | Martinsville, Va. | 800 |
| Arlington, Mass. | 1500 | Kelso, Wash. | 1600 |
| Brockton, Mass. | 1350 | Tacoma, Wash. | 850 |
| New Bedford, Mass. | 900 | Vancouver, Wash. | 667 |
| Newton, Mass. | 1050 | Greendale, Wisc. | 650 |
| Springfield, Mass. | 1160 | Wauwatosa, Wisc. | 550 |
| Dearborn, Mich. | 960 | West Allis, Wis. | 600 |
| Essexville, Mich. | 1000 | | |

NOTE: Where weights given vary an average is used.

Table VI—Weight of Garbage

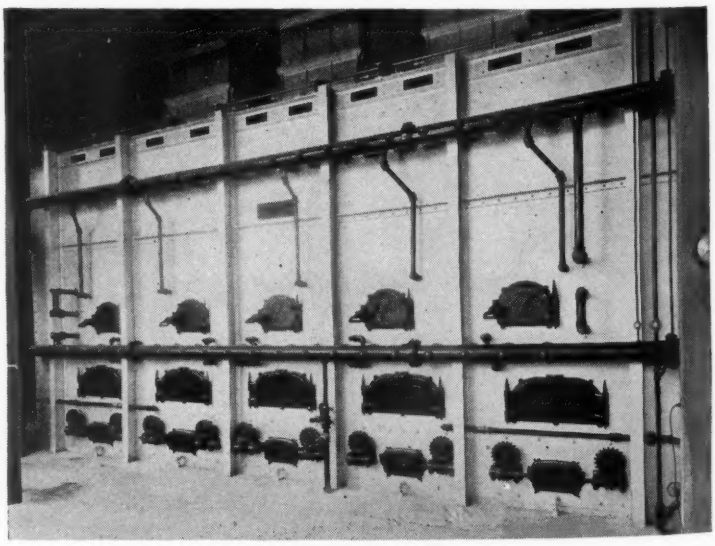
The contractor who collects garbage in Porterville, Calif., of which F. A. Savage is City Engineer, cares for the city sewer farm in payment. In San Luis Obispo, Leonard Longer, City Engineer, reports that the contractors have been using antiquated collection vehicles, but under the new contract will have to acquire modern collection units. S. G. Bennet, City Engineer of Santa Paula, Calif., reports that when pork goes below 7½ cents a pound, the city pays the contractor $25 per month for collection. In Colorado Springs, Colo., the contractor pays for the privilege of collection and there is no charge for residents, according to Frank O. Ray, City Engineer. B. G. Coy, City Engineer of Fort Collins, Colo., reports that this is also true in his city, but refuse and ashes are removed by the citizens at their own expense.

Fred J. McNair, acting City Engineer of Leadville, Colo., reports that the garbage situation there is not pressing. Leadville is near the top of the Continental Divide and for about 8 months every year it freezes every night. Most everyone has a coal fire and these provide means for burning all garbage. In Montrose, Colo., R. A. Finlayson, City Manager, garbage is collected by the contractor without cost and charges for refuse and ash collection are paid out of the general fund.

In Torrington, Conn., W. F. Nierintz, City Engineer, the city pays for collection and disposal costs out of taxes. There are 3 collection units, with steel bodies with compartments for garbage and cans. The charge for collection in West Hartford, Conn., F. B. Chamberlin, Town Engineer, is about 58 cents per $1,000 of valuation.

Statesboro, Ga., C. E. Layton, City Engineer, is this year starting a record of the amount of garbage per person, and is also revamping the garbage collection service. Two 12-yd. pick-up bodies will be put in service. Jos. J. Butler, Superintendent of Streets of Chicago, Ill., reports that in the collection service there are employed 232 motor trucks, 250 teams, 84 tractors and 487 trailers. Lowell D. Kerby, City Engineer, Danville, Ill., estimates the amount of garbage per person at 120 to 125 pounds. This city has just completed an incinerator and intends to discontinue feeding garbage to hogs.

G. R. Johnston, City Engineer, Murphysboro, Ill., reports that the cost of garbage collection amounts to about 8 cents per $100 valuation. At LaPorte, Ind., John E. Hupp, Jr., City Engineer, garbage is col-



Interior of Nichols Incinerator

lected in the cans, which are washed and reused. Benton R. Anderson, City Engineer of Clinton, Iowa, says: We have a 25-ton PDM incinerator built about ten years ago; before we had the incinerator, we dumped garbage along the river bank and let rats eat it, and we had millions of the brown rats. We now need new trucks and equipment badly.

Atchison, Kans., Dean Van Ness, City Manager, reports that city is now making a study of garbage disposal methods in an effort to improve the situation. Winfield, Kan., Max Sturm, City Engineer, keeps careful records of the amounts of garbage, which average 1.5 pounds per person per day. Garbage is incinerated and non-combustible material is dumped, using sanitary fill. In Malden, Mass., Thomas W. Sheehan, City Engineer, garbage is delivered by the city to tanks at a central point and then handled entirely by private contractors who bid for the garbage and haul it away to hog farms. The present contract is for three years.

H. H. Crow, City Manager, Benton Harbor, Mich., reports that rubbish and similar waste is used to build streets along the river bottom and also for filling an old canal basin to be used as a parking lot. Garbage is fed to hogs. A. V. Aronson, City Engineer, Escanaba, Mich., reports that garbage collections per person per day amount to about 0.05 cu. ft., and mixed collection to about twice as much. Otto K. Philipp, City Engineer, Flint, Mich., states that four trucks on ashes collected 34,289 cubic yards at an average cost of 63 cents a cubic yard and one truck on dead animals collected 2,649 at a total cost of $2,099. In 1939, garbage collection cost $56,865, refuse collection $21,671 and ash collection $9,050.

In view of a coming election, one of our readers gives his title as "rather in doubt" and says that his city does not collect garbage nor have any regulations regarding it. All collections are made privately by anyone who wishes to engage in this business. The vehicles used are the "salvage at the end of the road that all trucks travel" and in their passage through the city they do a very good job of littering up the alleys and the streets. What is left of the load when the final destination is reached is fed to hogs.

A. Lenderink, Consulting Engineer of Kalamazoo, Mich., reports for the village of Parchment that cans are used in garbage collection; the same practice is followed in Plainwell. W. L. Gillum, City Engineer, Washington, Mo., says that a contractor was licensed to collect garbage and tin cans at 50 cents a month, and for a time fed this to hogs within the city limits; this becoming objectionable, the farm was moved into the country, and the residents there objected. Most of the people have been burning their garbage in their heaters, but with so many oil burners and stokers this is now changing. Property owners take care of the refuse and the city puts on a clean-up week in April and October. Bozman, Mont., L. S. Thorpe, City Engineer, has been changing the garbage set-up; the proposed scale of charges takes a 1-family 4-room house as a base, charging for this $4 per year; each additional room adds 10% and each room less than 4 reduces the charge by the same amount. A special scale is being worked out for apartments.

W. H. Collisson, Jr., City Engineer, Ocean City, N. Y., says that the city has found from experience that when garbage is at a premium it pays to have separate contracts for garbage and for rubbish. The garbage is then fed to hogs and the rubbish spread on the marshlands in 5-ft. layers by means of a bulldozer and then covered with 12 ins. of gravel. When pork

| State | No. Cities Reporting | Methods of Disposal: Incineration | With Sewage | Feed Hogs | San. Fill | Burial | Dumps: Open | Dumps: Covered |
|---|---|---|---|---|---|---|---|---|
| Alabama | 11 | .. | 1 | .. | .. | .. | 9 | 1 |
| Arizona | 7 | 3 | .. | 2 | 1 | 1 | 4 | .. |
| Arkansas | 8 | .. | .. | 4 | 1 | 1 | 4 | .. |
| California | 79 | 3 | .. | 50 | 11 | .. | 24 | 8 |
| Colorado | 21 | .. | .. | 14 | .. | . | 5 | 1 |
| Connecticut | 19 | 2 | .. | 12 | 1 | 2 | 2 | 4 |
| Delaware | 4 | 3 | .. | 1 | .. | .. | .. | .. |
| Florida | 18 | 10 | .. | 3 | 1 | .. | 3 | 1 |
| Georgia | 16 | 4 | .. | 1 | 4 | 1 | 12 | 1 |
| Idaho | 9 | .. | .. | 7 | .. | .. | 8 | .. |
| Illinois | 60 | 15 | .. | 26 | 2 | 5 | 17 | 6 |
| Indiana | 37 | 6 | .. | 28 | 3 | 2 | 6 | 2 |
| Iowa | 41 | 3 | 1 | 16 | 7 | 2 | 14 | 3 |
| Kansas | 35 | 4 | .. | 25 | 1 | 2 | 8 | 2 |
| Kentucky | 13 | 4 | 2 | 4 | 2 | 1 | 3 | .. |
| Louisiana | 6 | 4 | .. | .. | .. | .. | 1 | 1 |
| Maine | 19 | .. | .. | 13 | 1 | 1 | 3 | 3 |
| Maryland | 1 | .. | .. | 1 | .. | .. | .. | .. |
| Massachusetts | 82 | 2 | .. | 45 | 1 | 2 | 1 | 2 |
| Michigan | 61 | 4 | 1 | 37 | 5 | 5 | 9 | 2 |
| Minnesota | 50 | 4 | .. | 15 | 2 | 2 | 25 | 11 |
| Mississippi | 9 | 2 | .. | 1 | .. | .. | 6 | 1 |
| Missouri | 29 | 1 | .. | 18 | 2 | 2 | 5 | .. |
| Montana | 16 | 1 | .. | .. | 2 | 1 | 10 | 4 |
| Nebraska | 16 | .. | .. | 3 | 1 | .. | 8 | 2 |
| Nevada | 2 | .. | .. | .. | .. | 1 | .. | 1 |
| New Hampshire | 6 | 2 | .. | 2 | 1 | 1 | 3 | .. |
| New Jersey | 52 | 10 | .. | 10 | 5 | 2 | 15 | 14 |
| New Mexico | 5 | 1 | .. | 1 | 1 | .. | 4 | .. |
| New York | 90 | 30 | .. | 25 | 4 | 5 | 17 | 10 |
| No. Carolina | 12 | 3 | .. | 2 | 1 | .. | 9 | 1 |
| No. Dakota | 12 | 2 | .. | 2 | 2 | 1 | 10 | 1 |
| Ohio | 73 | 15 | 1 | 40 | 1 | 4 | 12 | 11 |
| Oklahoma | 26 | 3 | .. | 14 | 3 | 1 | 6 | .. |
| Oregon | 11 | 4 | .. | 7 | 4 | 1 | 2 | 3 |
| Pennsylvania | 119 | 25 | .. | 40 | 12 | 7 | 39 | 12 |
| Rhode Island | 4 | .. | .. | 4 | .. | .. | .. | .. |
| So. Carolina | 9 | 2 | .. | 1 | 1 | .. | 7 | 1 |
| So. Dakota | 18 | .. | 2 | 6 | .. | 3 | 15 | 1 |
| Tennessee | 9 | 4 | .. | 2 | .. | .. | 4 | .. |
| Texas | 50 | 15 | .. | 19 | 2 | 4 | 30 | 3 |
| Utah | 7 | 4 | .. | 5 | .. | .. | 5 | 2 |
| Vermont | 9 | .. | .. | 6 | .. | .. | 4 | 1 |
| Virginia | 27 | 9 | 1 | 7 | 3 | 1 | 12 | 1 |
| Washington | 22 | 2 | .. | 7 | 7 | 1 | 9 | 6 |
| West Virginia | 12 | 6 | .. | .. | .. | .. | 6 | .. |
| Wisconsin | 49 | 8 | 1 | 19 | 6 | 4 | 8 | 12 |
| Wyoming | 8 | .. | .. | 1 | 1 | .. | 6 | .. |

**Table VII—Disposal methods**

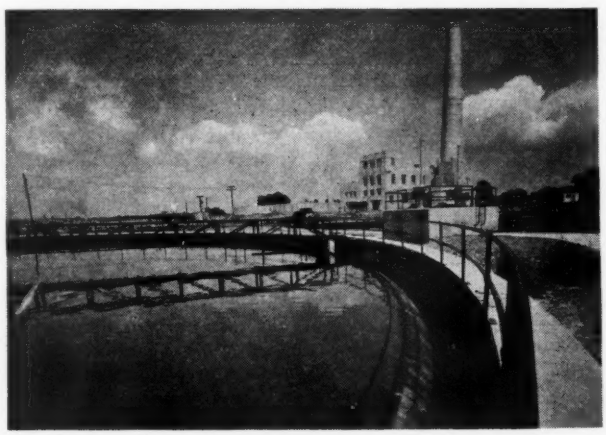
is cheap and garbage not needed, the city operates its incinerators, of which it has five. The contract with the collector gives the city the option of having the waste material delivered to the dump or to the incinerator.

In Greenburgh, N. Y., Dan C. Nolan, Jr., Town Engineer, the one-way length of haul to the dumps is 14 to 20 miles. Costs have averaged about 36 cents per $1000 valuation. Syracuse, N. Y., George H. Ballantyne, Commissioner of Public Works, employs reduction and converts garbage into fertilizer. A. R. Hollett, Engineer, Chapel Hill, N. C., reports that approximately 15 tons of mixed refuse per day are collected from 3600 residents and 3500 University students.

Arthur Smalley, City Engineer of Hamilton, O., sends us a detailed statement of collections of garbage, rubbish and ashes during 1939. This shows a total garbage collection of 10,600.05 tons, or an average of 0.193 ton per person for the year. The rubbish for the 8 months recorded (the last 8 months of the year) totalled 7,506.85 tons, or an estimated 11,260 tons for the year. With a population of 55,000, this gives a production of mixed garbage of 410 pounds, this comprising garbage and combustible rubbish. No check has been made regarding the weight per ton, as this varies considerably. In Lakewood, O., E. A. Fisher, City Engineer, garbage and combustible refuse are collected together. In 1939, there were 16,568 tons of this material collected; based on a population of 74,360, this amounts to 472 pounds per person per year. The 1938 collections amounted to 17,136 tons and the 1937 collections to 14,990 tons.

Wyoming, O., F. G. Gedge, Public Service Inspector, is a wholly residential community of 4600 population, composed of 1260 family units. Collection is from the rear door; garbage and combustible materials is separated from ashes, tin cans and bottles; garbage is wrapped. Elgin units are operated with a driver and two men. Helpers are supplied with rubber tired hand trucks for collection of waste and bringing it to the street for loading into the trucks.

H. B. Dickerson, Street and Water Commissioner, Sisseton, S. D., states that city is working out the details of a waste collection system at the present time. W. S. Tanner, City Engineer, Bryan, Tex., says that garbage is not required to be collected separately; the total waste collected per person per day amounts to 0.5 cu. ft.



**Building housing C-E Raymond System at Buffalo, in background. Capacity, 42 tons of dry solids per day.**

# For CLEANLINESS and HEALTH Collect GARBAGE & RUBBISH The NEW SANITARY WAY

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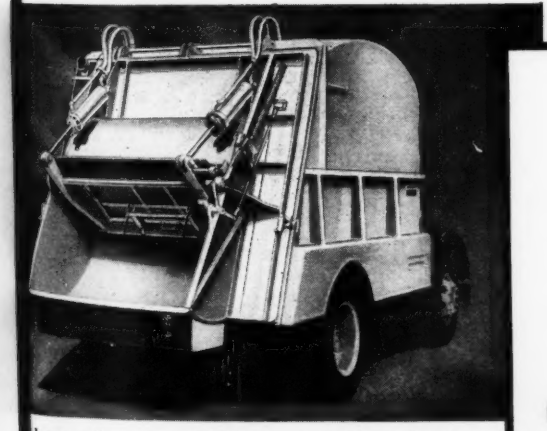
Low loading sill for faster, easier loading.

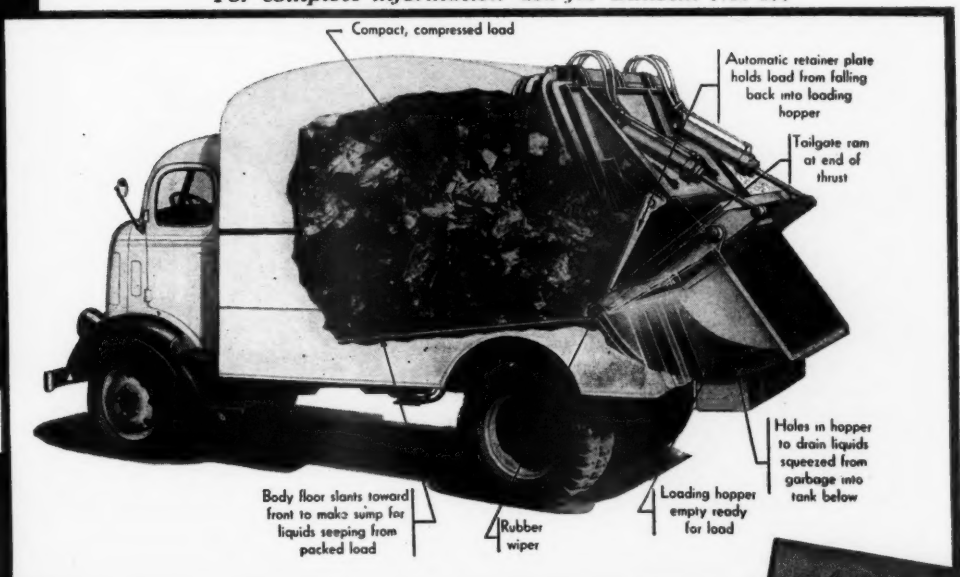
## The GAR WOOD LOAD-PACKER

**Offered exclusively by Gar Wood Industries, Inc., the new Gar Wood Load-Packer is the newest, fastest, most sanitary and economical unit for collecting and hauling garbage and rubbish. All-enclosed body with only one opening for loading. Odors are confined. Papers cannot blow away. No unsanitary trough or bucket on outside to permit spillage. The Gar Wood Load-Packer operates like a hydraulic baler—compresses all types of garbage, refuse and rubbish into a compact load—accommodates greater loads in comparison with other types of bodies of similar capacity by reason of compressing the load. Liquids are squeezed out allowing garbage to burn faster.**

***For complete information ask for Bulletin No. 27.***



bage, refuse or rubbish rammed into body.




ompressed load slides out cleanly and quickly.

**Two hydraulic cylinders thrust the tailgate ram against the garbage in the loading hopper, ramming it from the hopper and packing it into the body. This operation cleans out the hopper.**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# Electric Motors and Controls for Sewage Treatment Plants

By J. O. KAMMERMAN

Professor of Electrical Engineering, South Dakota School of Mines

IN OUR modern sewage disposal plants, electric motors are employed in practically every operation in the treatment cycle, from the pumping of raw sewage to the pumping of final effluent; from the mechanical cleaning of bar screens to the incineration of sludge.

Various types and classes of motors are available for sewage plant apparatus. It is difficult to establish any hard and fast rule which would definitely determine the proper motor for any particular machine. The location of the machine, the climate, the type of sewage handled, and other factors, will influence the final selection. Each of the factors must be taken into consideration by the engineer for each particular installation.

Specifications for a motor to be used on sewage disposal equipment should include the following:

1—General type or class. 2—Horsepower. 3—Speed. 4—Voltage. 5—Frequency. 6—Number of phases. 7—Type of bearings. 8—Type of insulation. 9—Temperature rise. 10—Mechanical construction. 11—Type of drive. 12—Mounting arrangement.

Some of these factors are fixed and do not need special consideration. Voltage frequency and the number of phases depend upon the available power supply. The horsepower, speed, type of drive, mounting arrangement and the general type or class are determined by the characteristics of the machine to be driven. Therefore, the sanitary engineer is concerned mainly with the type or class of motors, bearings, temperature rise, insulation, and mechanical construction.

## Types of Motors

The types of motors with which I will deal are as follows:

1—Direct current and single phase motors. 2—Synchronous motors. 3—Constant speed squirrel cage induction motors. 4—Multi-speed squirrel cage motors. 5—Wound rotor induction motors.

*Direct current motors* are seldom used, even for small horsepower sizes, on sewage disposal work. The explosive gases present make the direct current motors a decided hazard. Single phase alternating current motors are used on some small auxiliaries and special apparatus, but their general use in sewage plants is quite limited. Under no circumstances should they be employed in places where there is liable to be a collection of explosive gases.

*Synchronous motors* are used mainly on large sewage or sludge pumps and on air compressors in activated sludge plants. The synchronous motor, when overexcited, acts as a condenser and improves the power factor of the circuit. A synchronous motor so operated in a plant containing anywhere from 10 to 20 small induction motors will very materially improve the power factor of the plant as a whole. A study of the system may indicate that a synchronous motor, with the leading power factor, will improve the plant power factor to such an extent that an appreciable saving will be made in the electric power bill.

The synchronous motor has slightly higher efficiency than an induction motor. This would prove advantageous, especially on a drive that operates 24 hours a day. These motors operate at a constant speed, regardless of the variations in load. The synchronous motor, with its exciter and control apparatus, costs a little more than the same size induction motor. This motor could not be run in localities where there would be an accumulation of explosive gases.

The *constant speed squirrel cage* induction motor is divided into several classes. The Class A or normal torque, normal starting current is the simplest and least expensive and therefore the most widely used. This type of motor will develop a starting torque of some 105 to 175% of full load torque, depending upon its size and speed. This is sufficient for most applications in sewage disposal plants, such as centrifugal pumps, fans, screens, collectors, mechanical aerators and air compressors, started unloaded.

A Class B motor has normal torque and low starting current. This motor develops approximately the same torque as a Class A motor, and can be used on the same types of machine. It is designed, however, to start on full voltage with relatively low starting current. The Class B motor costs more than a Class A motor.

The Class C motor is designed to give a high torque and a low starting current. This high torque is required to start certain types of machines, such as compressors which start under load.

A Class D motor is a high-slip motor which develops a relatively high starting torque and has a large slip. These motors are suitable for use on gate valves. The high-slip characteristic reduces the chances of damage to the valve or motor, in case the valve becomes stuck or clogged.

Since the selection of one of these classes of squirrel cage induction motors depends on the torque and duty required of the driven apparatus, the advice of the machinery manufacturer should be followed.

A *multi-speed squirrel cage motor* is one designed so that it can be operated at any one of several definite speeds. The various speeds are usually obtained by various whole groupings of the primary windings. Two speeds can be obtained from one winding, but the higher speed must be twice the lower speed. As an example, one can purchase a motor with speeds at 1200 and 600 r.p.m., or 1800 and 900 r.p.m.; by adding a second winding, two more speeds can be obtained. Multi-speed motors may be obtained with different starting points and torque characteristics, and again the division regarding the type of motor to be used should be left up to the manufacturer of the machinery that is to be driven.

A *wound rotor induction motor* may have its speed varied by inserting resistance in the secondary or rotor circuit. The efficiency of this type of motor is lower than that of the squirrel cage motor and it is much more expensive.

If the speeds obtainable in a multi-speed motor will give satisfactory operation, it should receive preference over a wound rotor motor. Wound rotor motors should not be used in locations where there is liable to be a collection of explosive gases.

*Explosion-proof motors* must be employed where there is a distinct hazard, due to the accumulation of explosive gases. As an instance of this, pumps installed in a digester should be driven by explosion-proof motors.

The explosion-proof motor is sometimes called the totally enclosed motor. As its name implies, all gases are kept out of the frame of the motor and therefore, in case of a spark in the windings, no explosion will take place. It has been found that an explosion-proof motor will breathe in moisture around the bearing seal if the atmosphere in which the motor operates is extremely humid. This is particularly true if the motor is operated intermittently and is continually heating up and cooling down. As the hot motor cools down, a vacuum is created within the housing and this vacuum tends to suck the moist air through the bearings into the windings of the motor. I would advise that if possible, and even at additional expense, the plant be designed so that no motors will be installed in places where explosive gases are liable to accumulate, thus avoiding the use of explosion-proof motors.

The *drip-proof motor* is one designed with the motor housing and frame so constructed that water dropping on top of the motor will not get into the windings. The windings of this type of motor should be impregnated with a compound which will not be affected by moisture. This type of motor is cheaper than the splash-proof motor, which I will discuss next.

The *splash-proof motor* is the type of motor now most widely used around sewage disposal plants. The frame and end bells are so constructed that a hose can be turned on the motor from any angle and yet water will not get into the interior of the motor. The motor is not totally enclosed, there are air channels through the end bells that allow free expansion and contraction of the air within the case as the temperature changes. These air channels are so baffled and drained that water cannot enter the interior of the motor. The windings of these motors should be impregnated so that any moisture that might accumulate on the windings will have no bad effects.

A recent addition to the motor family is the gear motor. It consists of a high-speed motor combined with a center and compact induction gears, to give practically any desired low speed. Gear motors are applicable to many machines used in sewage plants, but it is not advisable to use them unless they are recommended by the manufacturer of the apparatus which is to be driven.

This is a portion of an article by Prof. Kammerman in the "Clarifier," publication of the South Dakota State Board of Health. The remainder will appear in an early issue.

## Gas-Tight Joints on Digestion Tanks

The Columbus, O., sewage treatment plant had considerable trouble with gas leakage around manhole frames and gas domes on the digestion tanks, the lead gaskets proving too stiff to permit the covers to be bolted down to a gas-tight joint. After trying other materials, a putty called "Trimco" was found most satisfactory. Also it was found that to hold a gas-tight joint with a standard 24" manhole cover, sixteen ¾" bolts were necessary instead of the eight ½" ones used at first.

How the transformed right-of-way looks. At right, detail of curb construction.

# Railroad Right-of-Way Transformed into Concrete Street

By M. H. KINCH
City Engineer, Urbana, Ill.

WHAT used to be the main-line right of way of the Illinois Terminal R. R. along Railroad Street in Urbana, Ill., has been transformed into a usable concrete street. Not only was the face of the street changed, but its name, as well: It is now Western Avenue.

Although the improvement is only two blocks long, it is of much greater public benefit than its size would indicate. Houses along the street were practically inaccessible by automobile. Also, the unpaved right of way was a nuisance.

One railroad track was left in temporarily for hauling coal to the University of Illinois until the new power plant is completed. To adjust the grade of the street and curb to the existing track and sidewalks was somewhat of a problem since the sidewalks, placed some years ago, were much lower than the base of rail. The track area had to be left high, and the two 6-in. uniform concrete strips on each side were placed at a compromise grade between this and the sidewalks. When the track is removed, it will be simple to pave the track area at the lower grade. Meanwhile, the different grades interefere little with traffic.

Curb construction was somewhat unusual. Paving was put down for the full width including the curb base. From this base dowels extended vertically on 12-in. centers. These dowels tied the curb to the slab. We have found this method of building curbs economical, since it is not necessary to disturb the slab itself when service entrances are cut. The pavement slab may be finished by machine by use of this type of curb, whereas the use of a curb and gutter would require the placing of a larger quantity of concrete by hand and the placing of larger and heavier forms.

The work was done by the General Paving Company, of Champaign, at a contract price of $8,949. The work was paid for by special assessment bonds. The railroad granted the city the necessary title to make the improvement.

## Raw Garbage and Trichinosis

A recent statistical study by the New York State health department, quoted in the New Hampshire Health News, shows that in the past decade the number of cases of trichinosis in that State as a whole has more than doubled, while for New York City the number has more than tripled. That a similar situation could be demonstrated in not a few other States cannot be doubted, and it also can be asserted that the increasing prevalence of this disease is due in the main, if not almost altogether, to the modern extensive practice of raw garbage feeding to hogs.

In connection with a survey which this New York department has just completed, it says:

"As to methods of disposal, about one-third of the municipalities, representing about one-fourth of the population in cities and incorporated villages, dispose of their garbage by feedng it raw to hogs, and about one-sixth dispose of garbage solely through incineration. Only 11 of the 580 communities studied dispose of garbage through feeding either domestic or commercial garbage to hogs after preliminary cooking, and three of these communities treat only one type of garbage in this manner and dispose of the other type improperly through feeding it raw to hogs."

# Salesmanship

By CHAS. G. RICHARDSON
Manager, Municipal Sales, Builders Iron Foundry

NOT long ago there was an address "over a nation-wide hook-up" by a well known and popular speaker on the subject of salesmanship. He claimed that a poor sales job has been done in this, the greatest market in the world, and that most of the selling actually has been not selling at all, but purchasing on the buyers' initiative. He also maintained that 70% of the goods that are sold by salesmen are sold by only 20% of them.

It is a fact that the days of high pressure, bang! bang! salesmanship are over, and well over. They were based on the false premise that the man who could secure the greatest number of orders in an allotted time was the "white-haired boy." And so he was, temporarily, but unfortunately for him and for his business concern, his winning score lacked the vital quality of repetition. The "Welcome" mat was rarely on the doorstep when he called a second time.

We can fully agree with the speaker in saying, "All of us have a warm memory of anyone who helps us to be a wise purchaser," and that "making a customer is more important than making a sale." From this point on, however, he led up to the conclusion that what we need is "Uninspired Salesmanship," and indeed this was the subject of his talk. Quoting further he said, "What is needed are men and women who go to their jobs as a farmer goes to his plowing; daily, doggedly, deliberately, plodding and plugging along," and he finally concluded that "Salesmanship is not a question of enthusiasm but of persistence based on knowledge."

Frankly, I was disappointed in the way a most excellent discourse ended. Those who earn a living "selling things," whether brushes or power shovels, apparently are to regard their efforts as just a daily grind, and are to be thankful when they can crawl between the sheets to store up sufficient energy for another sombre eight hours of toting the old brief case.

Why, only a few blocks from where I live is a chain grocery store whose manager gets a lot of fun out of his long working days. He knows all of his customers by name, always inquires about their personal health or something of interest in their family, sympathizes with their misfortunes, tells them of the special bargains of the day, and helps the women carry their large bundles out to the car. And does his store hum with business to the merry tinkle of the cash register! And does trade fall off when "Walter" is sick!

If I may be pardoned a personal reference, I recall a time I decided to buy a new automobile. Having had good satisfaction with a certain make, I asked for a ride in the latest model. The salesman arrived with a demonstrator car which was not the type in which I was interested; also, he explained that it needed "going over," so not to mind an imperfect clutch, a little hard spring action, and a few squeaks. Furthermore, he spent most of the tedious trip in talking about other subjects, except as I questioned him at intervals on certain mechanical features. He was, indeed, doing his daily grind, and "without enthusiasm." There was little comment by him about the newest gadgets, nothing about greater smoothness of

control or improved efficiency of performance. Neither was there any inquiring whether it was the best model for my personal requirements. Had he been capable at his job he could easily have had a second order that afternoon, but a few days later I purchased another make of automobile. Thus his uninspiration not only lost an order, but his company a repeat customer.

Whatever the product, *the rendering of helpful service* to the buyer is the prime requisite of successful selling.The real salesman has the ability to project himself into the purchaser's place and to approach the transaction from the latter's standpoint instead of endeavoring to get the signature on the famous dotted line as quickly as possible. Many who read this journal are concerned with selling equipment for public works, where there are important engineering and technical considerations involved. In this field unusual opportunities for helpful service are presented, which, if it is faithfully and ably performed, not only achieves material results, but often builds lifelong, personal friendships.

No, not Uninspired Salesmanship, but Satisfying Salesmanship is the true criterion.

## Road Ponds—A Letter to the Editor

The Editor of PUBLIC WORKS.—Under "Comments by County Officials" in the May issue of PUBLIC WORKS I have been credited with building road ponds and you have asked "What are road ponds?"

In our county, which is of a rolling nature, we have a few very deep draws or gullies that require a fill of from 20 to 30 feet in height in order to hold a grade of 6%, which necessitates a culvert from 60 to 70 feet long. In order to cut the expense of such a long culvert we have been able in several instances to move the culvert up the side of the hill toward the end of the fill thus cutting the length of the culvert as much as half and making a pond from 10 to 15 feet deep with only the additional expense of rip-rapping and cutting of a small diversion ditch to keep the water from cutting the toe of the fill.

We have constructed two of these ponds with WPA labor and have others in for approval. We have found that the land owners have a very friendly attitude toward these projects.

Hoping this answers the question in a satisfactory manner, I am

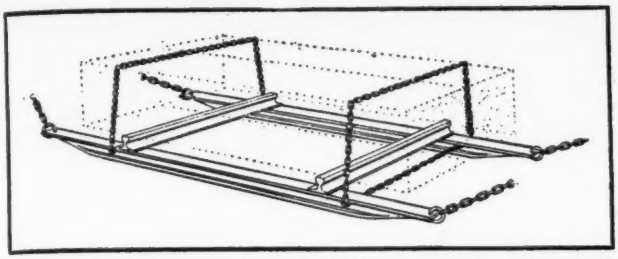
Yours very truly,
ROY E. McDOWELL
County Engineer,
Phillips County, Kansas.

## Sewerage in South Dakota

The State of South Dakota contains 300 incorporated municipalities. Of these, 104 have sewerage systems; 73 treat the sewage, 36 with sedimentation only. The 37 giving oxidation treatment also contain a population of 143,885, or 49.7% of the urban population of the state, or 62.2% of the sewered population.

Most of the treatment plants consist of Imhoff tanks, with or without filtration. Most of the larger plants have mechanical sedimentation units with separate sludge digestion and filtration.

These data were obtained by the Sanitary Engineering Div. of the State Board of Health, by means of a questionnaire conducted early this year. Population figures given are those of a 1935 census.



A sled for moving heavy pipe or girders is made by welding old rails together.

## Expressing the Injury Index by a Single Number

There are times when it may appear desirable to express figures for injuries due to construction accidents with a single index number. Some organizations do this by using the accident frequency rate, while others use only the severity rate. A few use a combination of these. Insurance company engineers generally consider the loss ratio, which is the percentage obtained by dividing the compensation and medical expense by the insurance premiums, the normal figure being approximately 60% in states where compensation insurance is provided by private insurance companies. The ideal index figure would show the relationship of the accident frequency and severity rates in a manner that would be significant, and in all probability this would tend to parallel the loss ratio figures year by year. The U. S. Army Engineer Corps uses an index figure obtained by adding the frequency rate to the severity rate. R. E. Donovan of the Standard Oil Company of California has developed an index figure for his organization by multiplying the frequency rate by the severity rate by 10. Since the severity rate closely follows the loss ratio figures, and since there are no radical changes in the frequency rates, this works out very satisfactorily. The multiplier of 10 is used to give better vertical presentation graphically, and in this particular case results in the Injury Index graph following the loss Ratio graph consistently.—"Safety News."

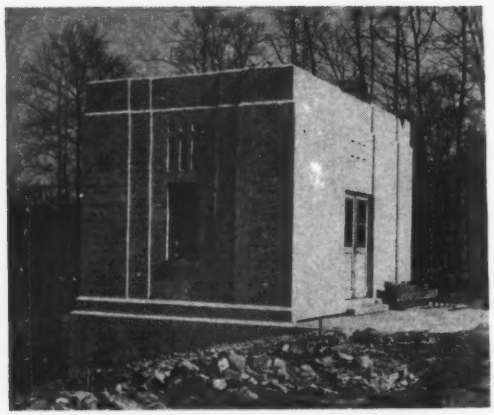
## Atlanta Lets Contract for New Filter Plant

The Atlanta, Ga., Water Works recently awarded a filtration extension contract totaling approximately $350,000. The new unit will have a capacity of thirty-three million gallons per day. The present filtration capacity is about thirty-nine million gallons every twenty-four hours, but will be increased to seventy-two million gallons when the six contracts in connection with the contemplated seven unit improvements are completed.

The general manager, W. Zode Smith, announced that the Smith-Pew Construction Company, Atlanta, Georgia, was awarded the major building structure contract calling for an expenditure of $159,800.00. Other contracts were as follows: Roberts Filter Manufacturing Company, Darby, Pa., $128,560.40; Builders Iron Foundry, Providence, R. I., $16,404.00 and others totaling approximately $350,000.00.

Recommendations filed with council indicated that the above awards were made to lowest bidders. The contract is to be completed in about a year.

Wiedeman and Singleton, Engineers, Atlanta, Georgia executed the plans for this extension.



Gate house at sedimentation tank of Ashland, Ky., waterworks.

# The Waterworks Digest

**Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.**

## Water Meters In New York City

Half the cities in the United States are fully metered, including Boston, Cleveland, Detroit and others of the largest size, but only 26% of New York City's services are metered, although this totals 173,000 meters. These meters receive the minimum amount of care that any meter system can have and still function. The meters are purchased, installed and maintained at the expense of the property owner, but to meet the approval of the Board of Estimate. Practically all makes of disc and current meters are in use. Practically all repair work is done by nine private companies. In general, meters do not receive any attention until they stop registering. One meter ran 26 years without attention of any kind, making 95,000,000 nutations, and when tested in 1939 showed 34% slippage. Another, which had been in service 32 years and repaired four times and made more than 500,000,000 nutations, showed 78% slippage.

With New York water, deposit forms on the piston and piston chamber of disc meters, and on the blades of pistons of the turbine type, causing both, but especially the latter, to overregister.[F43]

## Dewatering for Deep Pump Well

Part of the new water supply project for Grand Rapids, Mich., is a pumping station in a circular pit 70 ft. diameter, carried to a depth 31 ft. below lake level. An inner circular wall provides an annular space 6½ ft. wide that is used as a wet well. The soil is sand saturated with water from the lake. Instead of using a sheet piling coffer dam, the excavation was carried down with side slopes of 1.1 At lake level a 2½ ft. berme was left and on this was laid a header ring for well points 25 ft. long, spaced 3 ft. along the header. After 48 hrs. of pumping, excavation was continued for 18 ft. depth; then another ring of well points 2 ft. apart was laid on a 2½ ft. berme and, after 3 days' pumping, the remaining depth was excavated. Pumping continued night and day with two pumps for each header ring and the hole kept dry. The bottom was covered with a reinforced concrete slab 4 ft. thick. Well points are also being used for dewatering the trench for laying 30 miles of 46" pipe, using three well point sets, each with 1,000 ft. of header.[E11]

**HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.**

## Rapid Tunnelling On the Delaware Aqueduct

In construction on the Delaware Aqueduct of New York City's water supply during 1939 and 1940, tunnels of 15 ft. and 19.5 ft. finished diameters are averaging about 140 and 125 ft. per week respectively—about four times the rate of the new Croton aqueduct, 10.5 ft. to 14.25 ft. diameter, built fifty years ago. This is due to improved methods and equipment, the latter being heavy and of large capacity, much of which would be creditable to a modern permanently producing mine.[F40]

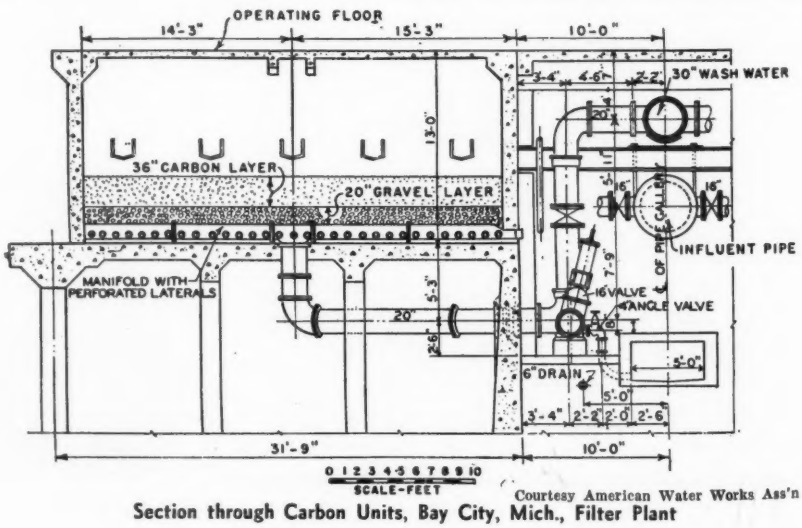
## Manholes by Caisson Method

Precast concrete boxes up to 11′ x 4′ 2″ x 6′ 6″ deep have been cast on the surface and sunk by the caisson method, using a clamshell bucket, by the New York Consolidated Edison Co. This method is cheaper and safer than the built-in-place procedure, and more convenient to the public since it is completed in one day.[E14]

## Use of Granular Activated Carbon

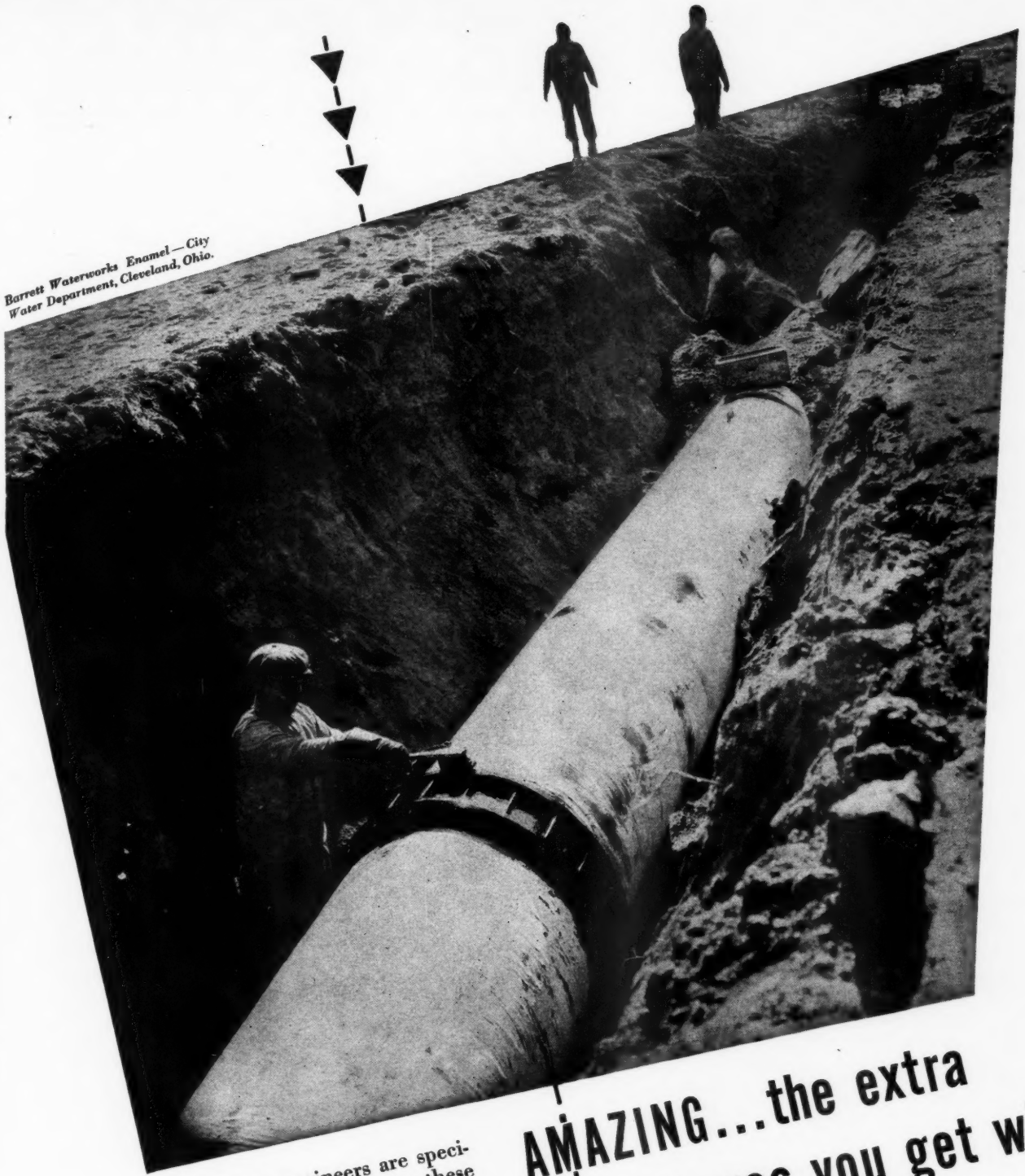
Bay City, Mich., has used granulated carbon filters since 1930; now has 8 mgd capacity. Five other cities in Michigan, Wisconsin and California use them. Conclusions from experience and research are that, where intensive taste and odor would require use of excessive amounts of powdered carbon, granular carbon should be considered; but powdered carbon should continue to be used to the point where increase in dose would cease to be effective. Definite specifications for granular carbon and further research are necessary.

Powdered carbon costs less per pound than granular and is easy to apply in existing plants; there is no very satisfactory test for evaluating




Courtesy American Water Works Ass'n

Section through Carbon Units, Bay City, Mich., Filter Plant



*Barrett Waterworks Enamel—City Water Department, Cleveland, Ohio.*

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WHEN so many waterworks engineers are specifying Barrett Enamels, you may be sure these coatings have important and exclusive advantages.

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granular carbon; reactivation is not economical. But where conditions are so bad that powdered carbon will not give satisfactory taste removal, supplementing with granular filters probably will do so.[A78]

### Distributing Copper Sulphate

Syracuse, N. Y., originally distributed copper sulphate in Lake Skaneateles by dragging burlap bags of it from a boat, but the local fish and game club claimed fish were killed by high concentration due to poor distribution, and during the past two years a copper sulphate solution has been sprayed on the surface, in lanes 30 to 40 ft. wide, parallel to the trough of the waves and approximately 500 ft. apart. Eleven tons is applied in 24 hours—a longer time than required by the old method. Carefully graded crystals are dissolved in a tank on the boat and the solution pumped through hose to nozzles mounted on the end of outriggers.[A74]

### Carbonaceous Zeolites

These possess three properties not found in siliceous zeolites: (1) They produce a water of 0 to 2 ppm hardness in either the hydrogen or sodium cycles, being regenerated by either acid or salt. In the hydrogen cycle, besides removing hardness they remove alkalinity by changing bicarbonates to carbonic acid which is then removed by mechanical degasification. (2) They can remove sodium bicarbonate. (3) They can soften water low in silica without danger of silica pick-up from the zeolite itself. They are especially interesting to manufacturers of ice and of carbonated beverages, and to steam boiler users.[A77]

### Algae Growths and Ultra-Violet Radiation

Los Angeles, Calif., by selecting periods for dosing its reservoirs with copper sulphate on the basis of intensity of ultra-violet radiation rather than temperature, has reduced the amount used from 107.5 tons in 1933-4 to 60 tons in 1939-40. The present practice is to treat the reservoirs when the algae counts are high or rapidly increasing coincident with either a high total amount of radiation per day or increasing rates of intensity. In winter, radiation exposure averages 7½ hrs. a day, intensity 6.2 impulses a minute. In the fall, 10-hour duration, 5.8 impulses. A typical summer day has over 11 hours exposure, 7.3 impulses average intensity; in the spring, 11½ hours, 12 impulses average intensity. Copper sulphate applications begin in April, reach the maximum in June, fall to about 50% to 70% of this through July to November, and fall to practically zero in December. The sulphate is applied in a dry sugar form, using a portable blower.[E19]

### Larvae in a Filter Plant

At the St. Paul, Minn., filter plant, in July and August, 1938, larvae of the phantom mosquito reproduced and thrived in the filter beds, in some way reducing the oxygen content of the water 50%. There was a stagnant odor around the plant but not in the effluent, and the sand particles were cemented together and cracked away from the walls. Larvae of the May fly and Caddish fly were present in May and June but did not lower the oxygen content. Daphnia and Cyclops at times cover the surface of the water, giving the appearance of a film of dust or oil, and are pulled down into the sand, at times cementing the sand and producing mud balls and cracks. Application of lime to the water kills the


**REPORTER:** If their hydrants froze, why not yours?

**FIREMAN:** There wasn't any water in our hydrants!

"No water? But there must have been!"

"Not *in* the hydrant . . . not until it was turned on. In our section we have Ludlow hydrants . . . drained completely from the very bottom, you see. When the water is turned off, the drain plug is automatically opened."

## LUDLOW HYDRANTS

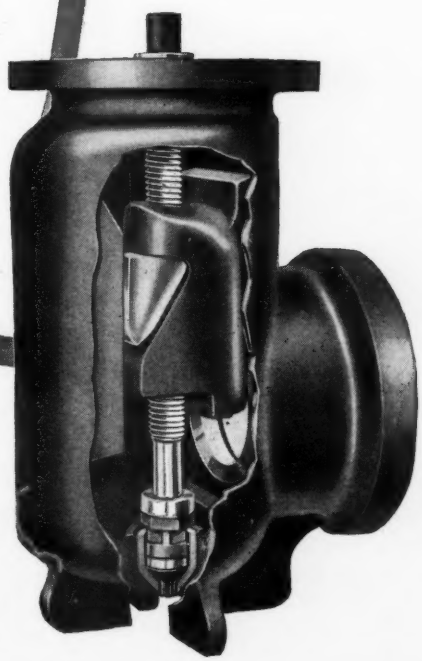
The slide gate principle, developed and perfected by Ludlow, insures *complete security* in fire hydrants. It provides *all* these advantages:

*Quick Water* with least possible shock. Proper shut-off without water hammer.

*Proper Drainage*. Hydrant automatically drained at lowest point when closed.

*No Flooding*. Accidental breaking of the hydrant, such as might result by collision from a heavy truck, will not cause flood since the gate when closed is wedge-locked.

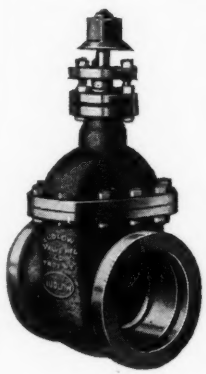
*Easy Inspection and Servicing* without unscrewing anything below the ground level. All working parts removed as one unit by lifting stem through top of hydrant.



## Ludlow Valves

The parallel seat, double wedge type slide gate valve, developed and perfected by Ludlow, has been the universally accepted construction in all waterworks valves for nearly three-quarters of a century. It provides *all* these essential benefits:

*Smooth, Positive Operation*. Gates positioned *directly* opposite ports before wedging, and entirely unwedged *before* being raised.



*Positive Closure* — even after years of service in the open position; flexible-action gates *self-adjusting* to seats.

*Self-Cleaning*. Rings cleaned *throughout entire stroke*. No *internal guides* to cause foul-up.

*Ready Replacement of Parts*. Simple construction and ample tolerances make possible ready replacement of parts.

### NON-CLOGGING DRAINAGE

Closure of hydrant automatically opens this drain, which is located at the lowest point. It remains open until automatically closed by the action of opening the hydrant.

The LUDLOW VALVE MFG·CO·INC· SINCE 1866 TROY·N·Y·

larvae and crustacea. Minnows in large numbers are placed in the coagulation basin and hold them in check. Prechlorination kills the micro-organisms but causes tastes and odors. The piscatorial method is considered the most satisfactory.[G19]

### Carp Resist Copper Sulphate

In an effort to eliminate carp from a fresh-water lagoon on Treasure Island, San Francisco, copper sulphate was applied in five doses of 1.3, 1.7, 1.7, 8.5 and 8.5 ppm respectively, during a period of two weeks, with no effect except that after the two last doses a few became sluggish. Then sufficient rotenone was applied to give 0.06 ppm concentration—double that reported to be sure death to fish, with similar results. The lagoon was then thoroughly seined.[E17]

### Automatic Control of Chlorination

Several types of equipment have been developed for the electrochemical control of chlorination regardless of changes in volume of flow or in chlorine demand, thus automatically maintaining any desired residual. One of these contains two electrodes, one immersed in the stream of unchlorinated water, the other in the chlorinated water; the two cells being so wired that their potentials oppose each other. The differential potential between the two is transferred to a recorder and, if desired, to a means for controlling the chlorine application.[E16]

### Laying 36 Inch Main Under Sewer

To carry a 36″ c.i. main under an 11 ft. by 12 ft. 3 in. concrete sewer running 90% full, 22 ft. below the surface of a marsh, neither open trench nor tunneling was considered advisable, and the pipe was laid in a 72″ corrugated culvert pipe 24 ft. long that was jacked under the sewer, the space between the two being then filled with concrete. The soil at the bottom of the 25 ft. trench was saturated running sand. To furnish a solid bottom to support the pipe for jacking, the trench at the end where the jacking was to commence was pumped dry and a 10″ reinforced concrete slab laid on the bottom. Jacking was performed as in similar work elsewhere, except that it was impossible to clear the soil away from the bottom of the pipe and the pressure of the jacks therefore was applied 10″ or 12″ from the bottom. Fifty-ton jacks were used. The average rate of progress was 0.4 ft. per hour, including all operations. The 24 ft. was jacked through true to grade and only ½ in. off center. The force consisted of engineer, foreman, 8 laborers and a crane operator.[A64]

### Cross Connection Check Valves

In the water supply systems of the East Bay Municipal Utility District, California, there are 498 double check valve installations on cross connections between the public and private supplies. There has been very little trouble with these during the past eight years and few leaky checks have been reported. In the last 1939 inspection, four installations showed leakage through one check, none through both checks. Three leaks were through 4″ checks, two of which had flat leather seats, the cause of leakage being ruffling of the leather, and the third had metal-to-metal seats and the leakage was due to corrosion of the face. The fourth was a 2″ check with corrosion between the arm and the disc, and at the hinge pin. Where a rubber or leather insert is provided in a groove in the disc or clapper very little trouble is experienced, al-

though occasionally some particle may be lodged on the face or in the insert. Where leather or rubber facings are not placed in grooves, they tend to ruffle or corrugate, and the best results have been obtained with rubber or fabric inserts set in grooves in the disc or clapper.[F41]

### Runoff From Heavy Rainfall

The heaviest rainfall on record for the district in and around St. Louis, Mo., occurred on Aug. 25, 1939. A fall of 5.02″ in 60 minutes was measured, and 3.92″ in 30 minutes. The storm covered an area of about 15 miles diameter, but was excessive over only about a quarter this. There were 36 rain gauges in this area, 11 of the recording type. A study of the falls recorded by these gauges was made to obtain data concerning relation of rainfall depth to the area covered. These relations, at 15 min. intervals during the storm, are shown by a number of diagrams that accompany the article. They show, for example, that fall exceeding 2″ in 15 min. occurred on an area of only about 1 mile by 0.3 mile; fall exceeding 1″ in 15 min. on an area about 6 mi. by 1.5 mi. Also, the maximum average rates for different intervals of time for various areas up to 48 sq. mi. are calculated.[L5]

### Sodium Hexametaphosphate

Sodium hexametaphosphate applied to water is adsorbed on iron and copper and their oxides, and prevents corrosion of such metals if a continuous film of it is formed. It is better to use 10 to 20 ppm at first until such film is formed, then drop to 1 or 2 ppm to maintain the film. It forms a film on the surface of nuclei of hydrated ferrous oxide, preventing further oxidation and precipitation that cause "red water"; to effect this, the water should contain 3 to 5 times as much metaphosphate as iron.[B8]

### Reservoir Leakage Reduced by Bonus

Contract for a 15 mg reservoir at Eugene, Ore., 20 ft. deep contained a provision for bonus or penalty of $3,000 per inch of water level drop per 48 hrs above or below an allowable 3″ drop; but 6″ drop or more would prohibit acceptance of the structure. The 3″ basis was based on the leakage from similarly designed reservoirs by the same engineers. The $3,000 was capitalization at 4% of cost of pumping (at $10 per mg) the equivalent of 1″ per 48 hrs for a year. Eight bids were received. Successful contractor received a bonus of $8,625, the drop in level being only ⅛ inch in 48 hrs. Attributed to careful attention to all details—7 sacks of cement per cu. yd.; copper expansion joints filled with poured asphalt, with care that copper is not deformed, this delayed until roof was in place; proper protection with wet burlap during curing; every square foot mechanically vibrated.[F53]

### Lead Service Pipe

Soils corrosive to lead pipe, in the order of aggressiveness, are: muck, cinders, sand, clay. Good drainage decreases the rate of corrosion. In corrosive soils, protect the pipe by wrapping or pitch-filled troughs. Certain salts in the soil may form highly insoluble protective coatings. In goose-necks the length should be 24 times the inside diameter for AA pipe and 30 to 36 times for AAA pipe; the curve should be horizontal; if the corporation is on the top of the main (which is undesirable) blocking should be placed under the goose-neck just beyond it. Long lead services in bad ground can be left wavy to allow for settlement.

Where there is excessive water hammer, if a lead service should burst it would act as a safety valve for the steel or other pipe in the plumbing system. Soft water high in $CO_2$ and oxygen may dissolve lead, but also affects other metals adversely.[B6]

## *Bibliography of Waterworks Literature*

***The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.***

*c.* Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

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75. Possible Use of Ohio Conservancy Act for Developing and Operating Water and Sewerage Facilities in Metropolitan Areas. By F. H. Waring. Pp. 570-575.
76. Water Plant Control As Affected by Stream Pollution. By I. N. Carter. Pp. 576-582.
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17. One Hundred Years of Pumping Machinery. By S. W. Kitson. Pp. 103-142.

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22. Routing the Delaware Aqueduct Tunnell. Pp. 54-58.

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23. Groundwater Situation Still Bad. Pp. 59.
24. Designing the Delaware Aqueduct. Pp. 84-86.

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*May*

15. Water Softening at Hamilton, Ohio. By J. E. Suedkamp. Pp. 44, 45, 77.
16. Water Rates and Service Charges. Pp. 79, 81, 83, 85.

K *Proceedings, American Society of Civil Engineers*
*May*

3. Masonry Dams: A Symposium. By I. E. Houk, K. B. Keener, R. S. Lieurance, C. H. Paul, J. Jacobs, I. B. Crosby, I. L. Tyler and B. W. Steele. Pp. 812-943.

L *Civil Engineering*
*May*

7. t. The Source of Water Derived From Wells. By C. V. Theis. Pp. 277-280.
8. t. Studies of Rainfall Intensity. By W. W. Horner and Students. Pp. 303-306.

M *Canadian Engineer*
*April*

7. p. Water Works Pumping, 1840-1940. By S. W. Kitson. Pp. 21-23, 33.
8. The Handling of Chlorine. By J. B. Baty. Pp. 24-25, 66-69.

Pump house and laboratory of the Monticello, Ill., sewage treatment plant. Imhoff tank at right.

# The Sewerage Digest

**A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published.**

### Clarification by Preflocculation

So-called non-settleable and colloidal solids can be made to settle out in a reasonable time by previously subjecting the sewage to a relatively short period of mechanical flocculation. This increases not only the solids removal but also the rate of settling. It is effective for raw sewage, and for treating trickling filter effluents ahead of settling, particularly with high-rate filters; but its use between aeration and settling in an activated sludge plant is probably not economical. The results obtained are comparable to those obtained by chemical treatment, but the floc is usually light and fluffy, settling more slowly than the denser and tougher chemical floc.

For preflocculating raw sewage, the flocculation period should be at least 30 min. and settling period 1.5 hr., and the clarifier overflow rate should not exceed 800 gpd per sq. ft.; higher removal can be obtained with 40 min. flocculation, 2 hr. settling and 600 to 800 gal. overflow rate. For trickling filter effluents, 30 min. flocculation, 1 hr. detention and 1,000 to 1,200 gal. overflow rates should be adequate.[C39]

### Chlorine for Grease Removal

The amount of scum resulting from pre-aeration can be greatly increased by introducing small amounts of gaseous chlorine into the air applied. At Woonsocket, R. I., applying 1.5 ppm of chlorine increased the grease yield 189% to 442% above that by aeration without chlorine. The greatest advantage in the use of aero-chlorination is that the total removal of grease is much greater than can be accounted for in the scum increase only; apparently it causes a more complete setting of the grease with the solids in the primary settling tank.[C40]

### Treating Winery Wastes

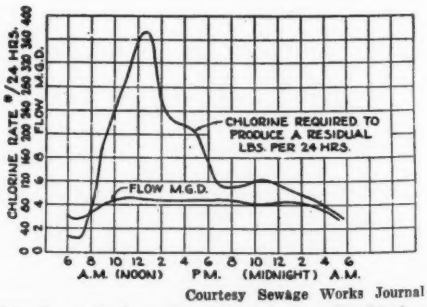
Wastes from a winery at Glenelg, Australia, caused such seasonal disturbances in the activated sludge plant used for treating the city's sewage that at times it became impossible to operate the plant. Experiments conducted during two winery seasons demonstrated that a 1:5 mixture of winery wastes and domestic sewage could be successfully treated by using excess quantities of lime, followed by dilution and pH adjustment, with subsequent treatment on two-stage biological filters.[C41]

### Adjusting Chlorination to Variation in Demand

The amount of chlorine dosage required to maintain a given residual varies from hour to hour every day, even more because of changes in strength of sewage than of changes in volume. In small plants this is often met by dosing at one constant rate during the day and at another during the night, but this is too wasteful of chlorine for large plants. Equipment is available for regulating the dose in proportion to the flow; but none is yet in common use for porportioning it to the chlorine demand. Some plants use the step-by-step method, in which the dosage rate is changed every two to four hours during the day, the rate selected for any one period being based on the average chlorine requirement of that period as determined by surveys and experience. A "potential chlorination" method has recently been developed, in which a small amount of sewage is passed through a cell containing a measuring and reference electrode, the potential indication being transmitted from the cell to a recorder, which in turn controls the dosage rate of a chlorinator. This appears to be the ideal method.[C40]

### Experiments With Activated Sludge

Effect of Sludge Concentration. Comparable B.O.D. removals from sewage can be attained with a wide range of activated sludge concentrations. The use of low concentrations results in the development of sludges with high volatile solids contents and high activities as measured by the base rates of oxygen utilization. Because of the high activity of such sludges, they must be removed rapidly from final settling tanks and kept in contact with dissolved oxygen to keep them in condition. The chief advantage to be gained in using low activated sludge concentrations is the decreased oxygen requirements to stabilize a given B.O.D. load. This is a result of the conversion of large quantities of the




Courtesy Sewage Works Journal

**Hourly variations in the amount of chlorine required to produce a residual in a plant serving 35,000 people**

# GENERAL CHEMICAL 'ALUM'

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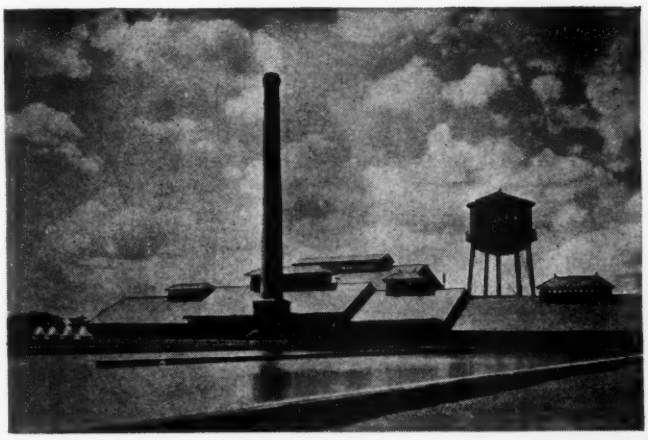

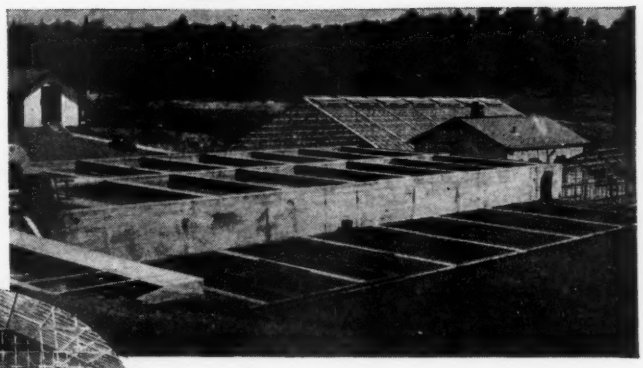

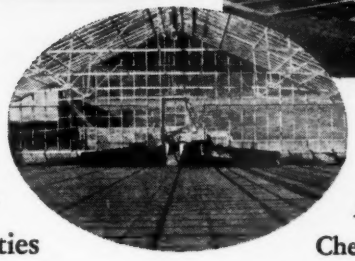

General Chemical Company Aluminum Sulfate is a first line defense against taste and odor troubles, supplementing other methods of control. Prominent water works authorities state that 25% to 50% of taste and odor may be removed in the settling basins by adequate coagulation. Such coagulation also carries down in the settling basins the filter clogging organisms which shorten filter runs.

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## General Chemical ALUMINUM SULFATE

available food (B.O.D.) to new sludge growth and, consequently, smaller amounts are oxidized to carbon dioxide, water and nitrates. The use of high concentrations of activated sludge results in the production of sludges with lower volatile solids content and lower base rates of oxygen utilization. Such sludges may be kept for much longer periods in the absence of aeration without undergoing serious changes and, as a result, more compact sludges are obtained. These two features constitute the chief advantages of the use of high sludge concentrations.

Effect of Temperature. Rapid growth of the organisms responsible for stabilization of the carbonaceous matter is favored by the lower rates of oxidation at low temperatures and by the ability of the sludge to hold available at all times a large food supply by adsorption and coagulation of sewage solids from suspension and solution. The growth of the nitrifying organisms is hindered because of the slowness with which ammonia nitrogen can be oxidized at low temperatures and because of the inability of the sludge to adsorb and hold available appreciable quantities of ammonia nitrogen. Thus, at low temperatures the proportion of nitrifying organisms in the sludge will diminish and the nitrifying ability decrease accordingly.[C37]

Carbon and Nitrogen Transformations by Zoogleal Bacteria. Approximately one-half of the $CO_2$ released by natural activated sludge during sewage purification was attributed to zoogleal bacteria. The zoogleal bacterium *zooglea ramigera,* thriving in sewage in the form of zoogleal flocs and capable of a considerable purifying action on the polluted water, is of primary importance in natural activated sludge. The role of nitrifying bacteria, protozoa and higher filamentous organisms can be considered secondary to the purification process brought about by the zoogleal bacteria.[C38]

### Treating Steel Mill Waste at Massillon, Ohio

Spent acid picking liquor in Massillon's sewage, discharged into the sewer undiluted, completely destroyed a pump impeller and the entire pump had to be replaced with acid-resisting iron parts. After this, all mills were required to neutralize the acid before discharge into the sewers and release it uniformly throughout the entire day. When so admitted it is a benefit, as the ferrous sulphate replaces the ferric chloride used for sewage treatment,

and only lime need be added for proper flocculation and pH control. In fact, experiments indicate that flocculation without lime is possible because of the alkalinity of the sewage and the aeration obtained by flocculation, and exceptionally high results are obtained at times.[J13]

### Memphis' Intercepting Sewer

Memphis, Tenn., completed last year an intercepting sewer to carry 27 mgd, the depth to the crown varying from 21 to 95 ft. and the material—water-bearing sand, gravel and clay—requiring pneumatic tunneling, the air pressure ranging from 2 to 28 lb. per sq. in. The sewer was built of reinforced concrete designed to carry the full load of the prism of earth as wide as the outside width of the sewer at the springline, together with the hydrostatic head of the groundwater above the springline. The sewer will be submerged when the river is 14 ft. above low water, but will discharge by gravity to a river level of 34 ft. At higher river levels the sewage will back up to a pumping station and be pumped over the levee.

Construction was carried on from 3 shafts, all lined with steel sheet piling. All surface buildings were of steel construction with concrete floors, and only steel was used for lining and bracing in the tunnel, to eliminate danger of fire.[E17]

*(Continued on page 56)*

## *Bibliography of Sewerage Literature*

***The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.***

*c.* Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
*March*

36. Critical Review of the Literature of 1939. Committee Report, W. Rudolfs, Chairman. Pp. 189-243.
37. t. Activated Sludge Oxidation: Effect of Temperature and Sludge Concentration. By C. N. Sawyer. Pp. 244-259.
38. t. Carbon and Nitrogen Transformations in the Activated Sludge Process. By H. Heukelekian and M. L. Littman. Pp. 260-279.
39. Improved Sewage Clarification by Preflocculation Without Chemicals. By A. J. Fischer and A. Hillman. Pp. 280-306.
40. Problems and Progress in Chlorination of Sewage. By A. E. Griffin and G. A. Campbell. Pp. 307-320.
41. Treatment of Winery Wastes at Glenelg, So. Australia. By H. J. N. Hodgson and J. Johnston. Pp. 321-340.
42. p. Notes on the "Cost of Sludge Disposal" Symposium. By J. W. Kirkpatrick. Pp. 341-345.
43. Operation Records and What They Mean. By K. Morkert. Pp. 345-346.
44. Spring Mill State Park Hotel Sewage Treatment Plant. By R. W. Heider. Pp. 346-347.
45. p. Sewage Disposal Plant for Tempe, Ariz. By E. W. Daley. Pp. 348-349.
46. p. Wahpeton Treats Its Sewage. By G. Swiggum. Pp. 349-351.
47. p. An Operator's Day at a Sewage Treatment Plant. Symposium. Pp. 351-360.

E *Engineering News-Record*
*May 23*

16. Stream Pollution Survey of the Ohio River. By E. J. Cleary. Pp. 52-55.
17. c. Building a Big Sewer in Bad Ground (Memphis, Tenn.) By W. B. Fowler. Pp. 56-59.
18. Hog Feeding With Garbage Under Study in Los Angeles. P. 68.

G *Water Works & Sewerage*
*May*

19. Consideration As To Sludge Density. By G. J. Wiest. P. 216.
20. Packinghouse Waste Treatment by Multi-Stage High-Rate Filtration. By L. R. Howson. Pp. 217-222.

H *Municipal Sanitation*
*May*

23. Landscape Treatment at Sewage Works. By C. B. Tilton. Pp. 228-231.
24. Glen Cove, Long Island, Modernizes Its Treatment Plant. By N. N. Wolpert. Pp. 232-233.
25. Designing Digestion Tanks. By R. Eliassen. Pp. 234-238.
26. Protecting Goldfish Ponds From Cannery Wastes. By J. B. Funk. Pp. 246-247.

J *American City*
*May*

12. Sewage Treatment Plant for Mason, Mich. By W. F. Shephard. Pp. 46.
13. Sewage Plant Handles Steel Mill Wastes. By R. F. Snyder. Pp. 60-62.

L *Civil Engineering*
*May*

1. p. Observations on Textile Waste Treatment. By C. W. Mengel. Pp. 267-269.
2. p. Pollution Abatement in New York Area. By S. G. Hess. Pp. 270-272.

M *Canadian Engineer*
*April*

2. p. Gas Hazards at Sewage Treatment Plants. Instructions to Operators. Pp. 73, 74, 77, 78.

P *Public Works*
*May*

27. Sewage Treatment Plant of Excelsior, Minn. By E. E. Bardwell. Pp. 16-18.
28. n. Owatanna's High-Capacity Filter Plant. P. 18.
29. Trickling Filter Equipment and Operation. Pp. 28-33.

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# Sewerage Digest

*(Continued from page 53)*

### Value of Treatment Records

Five major reasons for keeping records of the operation of treatment plants are: (a) To provide protective proof if and when law suits arise regarding allegedly poor operation of the plant. (b) To provide suitable data for the design of extensions to the plant. (c) To indicate whether the plant is functioning properly. (d) To make it possible to sum up just what has been accomplished. (e) To provide authentic data for monthly and yearly reports.[C43]

### High-Capacity Filters at Mason, Mich.

The treatment plant of Mason, Mich., put in operation last October, contains two high-capacity trickling filters 30 ft. in diameter with 8 ft. of blast furnace slag media and disc distributors with capacities of 150 to 350 gpm, and motor-driven fans capable of drawing through them 700 gpm of air. The surrounding walls rise 5 ft. above the filter media as wind protection. The floor system is of "Aerodrain" filter blocks. The concrete surfaces of wetwell, final tanks, filters, channels and control bases were given two coats of waterproof, acid-resistant coal tar pitch enamel, and all metal work is painted with aluminum paint.

During January, February and March the suspended solids averaged 174 ppm in the raw sewage, 33 in the final effluent; B.O.D. averaged 146 ppm and 41, respectively.[J12]

### Pasteurizing Garbage for Hog Food

Fontana Farms, which by contract with Los Angeles, Calif., buys its 200,000 tons per year of garbage at 50 cts a ton and feeds it to hogs, is, with the cooperation of the University of California and State B'd of Health, experimenting with steam pasteurization and dehydration. Pasteurized garbage is found to be 15% less effective than raw garbage in increasing weight of hogs because of loss of vitamins. Dehydration reduces moisture content from 70% to 10%; if higher than 10% the garbage may mold in storage; if less than 10% moisture is absorbed from the air.[E18]

### Treating Packinghouse Waste at West Fargo, N. D.

The plant for treating wastes of the Armour & Co. packing plant uses fine screens, grit removal, grease flotation, flocculation, primary settling, primary trickling filters, secondary settling, final trickling filters, final settling and discharge over an aerating cascade. The primary filters are equipped with air and water wash and operate at 5,000 to 6,000 lb. of B.O.D. per acre-foot per day; the floor is of "Armcre" block; air for backwashing is admitted through a grillage of 1½" pipe under 3 lb. pressure, capacity 2,000 cu. ft. of free air a minute. Effluent from the primary settling tanks shows B.O.D. reduction from 1,000 ppm to 250-350 ppm. This is probably aided by the high temperature of the sewage—80° to 85° F.

Flow in excess of the 24-hr. average rate is diverted to a storage tank, from which it returns to the sewage during the period of low flow of weak sewage, thus giving a more uniform load on the plant; this being effected automatically by a waterworks type rate controller. The plant consistently removes more than 95% of the B.O.D. The sludge, undigested, is air dried in lagoons without nuisance, resembling bed-dried digested domestic sludge.[G20]

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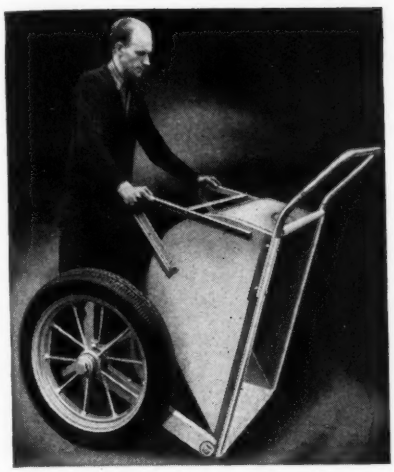
### Unavoidable Flooding in Construction Work

In actions for damages to property caused by the defendant contractor's obstruction of the flow of water through a culvert while constructing a conduit under contract with the city, flooding the basement through which the culvert ran during a rain storm, the Massachusetts Supreme Judicial Court held, R. Dunkel v. Barletta Co., 18 N. E. 2d. 377, that if the work could not have been done otherwise, the defendant would not be answerable unless the erection of the obstruction was performed in a careless and negligent manner, and that was a question of fact for the jury, which rendered verdicts for the defendant.

# Keeping Up With New Equipment



Jaeger Concrete Cart

## Jaeger Easy Dumper Concrete Cart

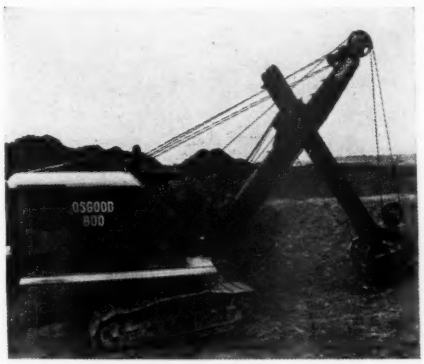
The "double pivot" is Jaeger's answer to a concrete cart that dumps quick and clean, and with half the energy required with the usual type. An improvement on the rocker or roll-over principle of dumping developed by Jaeger 17 years ago, this cart is operated by simply tipping it forward until the front lip touches the ground, whereupon the pivot point shifts from the axle to the front lip as you tip it further—one continuous movement and the wheels never leave the ground. Available in 6½ ft. and 9 ft. sizes, or high wheel type with 42 in. oval-tired steel wheels. Further details are described in new bulletin just issued by The Jaeger Machine Co., Columbus, Ohio.

## New Highway Mower with Hydraulic Controls

This new mower is called the "Little Giant." It is made by Little Giant Products, Inc., Peoria, Ill. It has twin sickles which are self-sharpening; it is claimed that these will cut cornstalks, hedge fence, small trees, etc., without damage to itself. The mower blade is placed at the rear of the front wheels where the operator can always observe it, and where guidance is easier. Controls are hydraulic; the cutter bar may be placed in any position and at any angle from 45° above to 45° below horizontal. Interesting photographs and data are available on request.

## Osgood Air Control Power Shovel

In the newest Osgood air control power shovel—the Model 800—all motions of the machine are controlled by air operated clutches. The air is supplied by a 2-cylinder compressor driven from the end of the power shaft. Control valves are of the meter type which permit smooth and exact handling. Among the air controlled units are the swing brake, the steering and the dipper trip. A new 30-page catalog tells all about this. C. F. Ebert, Osgood Co., Marion, Ohio.




Osgood Model 800 Shovel

## Recuperators for Better Incineration Operation

Recuperators are preheaters to improve the efficiency of furnace operation; they are widely used in industry and have been installed in a number of incinerators in the past few years. The Fitch Recuperator Co., Plainfield, N. J., has a catalog covering their recuperator tubes and "corebusters." The tubes are of carborundum, fully ample to withstand any heats to which they may be subjected; the corebuster is a special feature of design which keeps the air passing through the recuperator tubes in intimate contact with the tube walls, thus providing additional heating and contact surface. Full information on problems will be sent on request to the manufacturer.

## Gar Wood Low Price Scraper

Gar Wood Industries, Inc., Detroit, has placed a new, low-priced, dirt-moving, utility scraper on the market. The new model 23 Gar Wood Continental, 3-yard, 2-wheel, hydraulically-operated scraper is designed specially for use by counties, townships and small contractors and to replace older equipment.

Model 23 is designed to handle the many odd jobs which must be completed in fast time and at lowest operating costs. Used with medium weight tractors, it digs under positive pressure in all kinds of soil—loads, hauls and back dumps and represents the lowest investment per cubic yard of dirt-moving capacity. Raising and lowering of the cutting blade, closing the load and dumping are accomplished while in motion. Twin, two-way-action hydraulic jacks actuate the digging bucket and provide accurate and fast control by the tractor operator of all digging, loading and carrying operations.

Left—Little Giant Mower. Below—Gar Wood Scraper.

## Azochloramid-Plaster Mixture for Smallest Chlorination Problems

By preparing a mixture of plaster of Paris and Azochloramid, which contains after setting about 5% of Azochloramid, the world's smallest chlorinator can be constructed. A small portion of this mixture hung in a still body of water or placed on a filter through which water is flowing will release slowly and continuously active chlorine. It should be possible to use this method to keep a cistern clean, prevent sliming of filters and softeners and improve bacterial qualities of small water supplies. Wallace & Tiernan Co., Newark, N. J., have developed this product and will be glad to cooperate in testing and experimental work in connection with any problems.

### Tolman Rejoins Jeffrey Mfg. Co.

"Sam" Tolman, favorably and widely known in the sanitary engineering field, becomes manager of sales, Sanitary Engineering Division, the Jeffrey Mfg. Co., Columbus, O. Mr. Tolman was formerly associated with Jeffrey,

S. L. Tolman

but was superintendent of the Ward's Island Sewage Treatment Works, New York City, from Sept., 1938, until May 1, 1940, at which time he returned to Jeffrey.

### New Diamond Portable Quarry Plant

This new unit receives rock direct from the quarry shovel; after passing over a vibrating screen, the larger particles are returned to a 26 in. by 20 in. roll crusher. The unit has pneumatic tires and mechanical brakes; it is self-contained and driven with a 90-100 hp. diesel engine. Full data from Diamond Iron Works, Inc., Minneapolis, Minn.

### W & T Hypochlorinators

An 8-page illustrated booklet has been issued by Wallace & Tiernan Co., Newark, N. J., describing this unit and its application to small water supplies. Typical installation sketches are shown for three types of operation—electrical, water manual and water automatic. Ask for Publication 357.

## Evaluating Street Lighting

By C. F. Greeves-Carpenter

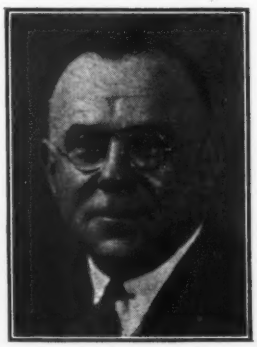
A simple instrument has been devised for evaluating street lighting. There are, according to Kirk M. Reid and H. J. Chanon of the General Electric Co., designers of the device, three important factors in street lighting which produce visibility: pavement brightness, obstacle brightness and glare. The new instrument accurately and quickly evaluates the relative visibility and the results afford a technically sound basis for luminaire design and for the determination of an efficient lighting program.

The lighting evaluator consists of three parts easily installed on an automobile and connected to the car battery. There is a simulated strip of pavement, which corresponds to the actual riding surface, resting on the hood of the car on which is positioned a test obstacle and a photometer which automatically records readings of pavement and obstacle brightness on an evaluation chart. A glare integrator is affixed above the windshield and houses a Luckiesh-Holliday "transparent diffuser" which integrates and measures in terms of veiling brightness (such as a fog) the glare from street lights and other sources in proportion to their interference with vision. Another photometer, combined with a periscope, permits readings from the driver's seat. Both photometers are controlled from an instrument box on the front seat and recordings are automatically made on an evaluation chart inserted in the instrument box.

## Federation of Sewage Works Association

The first annual convention of the Federation of Sewage Works Association meeting in conjunction with the 1940 annual meeting of the Central States Sewage Works Association is to be held at the Hotel Sherman in Chicago, Illinois, on October 3, 4 and 5, 1940.

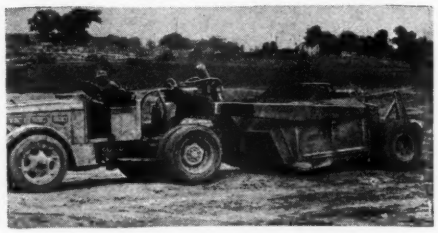
James R. Brown has been placed in charge of the newly opened Chicago office of the National Water Main Cleaning Co., located at 205 West Wacker Drive. Mr. Brown will have charge of sales in Kentucky, Ohio, Illinois, Indiana and Michigan.



J. R. Brown

## Heil Dig and Carry Trailer Scoop

This unit is of the semi-trailer type, with short turning radius and a scraper with hydraulic controls. It is available in four models: 6-yd. heaped, 4½ struck, using a 40-50 tractor; 8-yd.



Heil Semi-Trailer Scoop

heaped, 6.5 struck, 60-80 tractor; 12-yd. heaped, 9.5 struck, 75-90 tractor; and 16-yd. heaped, 12.5 struck, 95-120 tractor. Full data in illustrated catalog. Heil Co., 3000 W. Montana St., Milwaukee, Wisc.

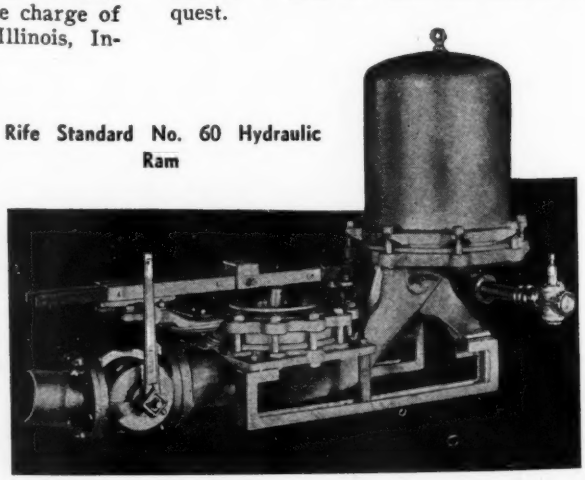
## International Power Units

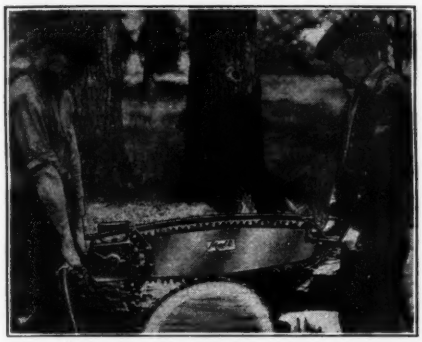
Two new power units have been developed by International Harvester Co., Chicago, Ill. These are the 100-hp. diesel, Model UD-18, 6-cylinder; and the 22-hp., Model U-2. The latter operates normally on gasoline but equipment is available for conversion to natural gas, distillate or kerosene. The larger unit starts on gasoline and after a minute or less of operation shifts to diesel.

## New Rife Hydraulic Ram

An improved type of hydraulic ram has been developed by Rife Mfg. Co., 75 West St., N. Y. This ram will lift water as high as 400 feet and will operate under heads up to 35 feet, but is also efficient for small lifts. A recent installation, where there was a fall of 18 inches, delivered water to a rock garden 16 feet above the stream. These rams are excellent for watering parks and recreation areas, for furnishing water to summer camps and hotels, and for other small water supplies. The power for operation is furnished by the water itself, so that outside power is not required. Full information on rams and their use sent on request.

Rife Standard No. 60 Hydraulic Ram





Two Mall Saw Units

### Mall Pneumatic Saw and Electric Vibrator Catalogs

Mall Tool Co., 7740 So. Chicago Ave., Chicago, Ill., has issued new catalogs describing their high speed universal electric vibrator and their new 12-inch pneumatic circular saw, which has many unusual features.

### Complete LeTourneau Catalog

A new 32-page catalog covering the entire line of equipment — bulldozers, angledozers, rooters, carryall scrapers, sheepsfoot rollers, pushdozers, treedozers and tractor cranes—has been issued by R. G. LeTourneau, Inc., Peoria, Ill. Excellently prepared and illustrated and contains information of value to the dirtmover and constructor.

### 1940 Rex Mixer Catalogs

Bulletin 360 describes the new 3½S tilting mixer; Bulletin 361 features the 5S and 7S mixers, made in either 2 or 4-wheel, end or side discharge models; Bulletin 362 covers the 10S and 14S mixers; and "Big Mixers" (28S and 56S) are described in Bulletin 363. Sent on request by Chain Belt Co., Milwaukee, Wisc.

### Hauck Speed-Master Melting Kettle

A new catalog, No. 658, illustrates and describes the improved Hauck Speed-Master melting kettle with the Kwiklean feature; the catalogue also covers a new combination skid and trailer kettle; barrel hoists; kettle thermometers and hand and power spray attachments; also the gas fired kettle using petroleum gas in cylinders. Hauck Mfg. Co., Brooklyn, N. Y.

## Water Quality and Treatment

This text, recently published by the American Water Works Ass'n., 22 East 40th St., N. Y., is a revision of the material originally published by the Association in 1925 as part of the Manual of Water Works Practice. There are 300 pages and 50 illustrations. $3.

### School for Water Works Operators Held at New York University

A two-week short school for Grade II water works operators was held at New York University, New York, N. Y., May 20 to June 1. The training was given by the Sanitary Engineering Department of New York University in cooperation with the State Health Department and the New York Conference of Mayors. Instruction was under the direction of Dr. L. R. Setter and F. H. Whitley. Another and similar course, but for sewage plant operators, will be held next winter.

### Pennsylvania Water and Sewage Works Operators' Associations.

The thirteenth annual conference of the Water Works Operators' Association will be held at State College, Pa., June 24, 25 and 26; the Sewage Works Operators will hold their 14th meeting on the 26th, 27th and 28th. Programs are now available. The secretary of the Water Works Operators' Association is I. M. Glace, 22 South 22nd St., Harrisburg. The secretary of the Sewage Works Operators' Association is L. D. Matter, State Board of Health, Wilkes-Barre, Pa.

New LeTourneau Model N Carryall

## International Diesel Power Units

Several months ago the International Harvester Company announced the new modernly styled 100-horsepower Model UD-18 Diesel power unit. Now, three new similarly styled and engineered International power units, all smaller than the UD-18, have just been announced. They are the UD-6, smallest in the new line which develops 39 horsepower at 1500 r.p.m.; the UD-9, the next in size which develops 53 horsepower at 1500 r.p.m.; and the UD-14. which develops 66½ horsepower at 1300 r.p.m. These are full Diesel engines. They are provided with a distinctive method of starting on gasoline; after a minute or less of operation they shift to full Diesel. When the change-over is made, spark plugs, carburetor and auxiliary combustion chambers used on the gasoline cycle are shut off and have no connection with the Diesel operation. International Diesels may be cranked by hand as easily as gas engines of like sizes.

## Bucyrus-Erie New Four-Wheel Scrapers

A new improved line of four-wheel scrapers, in a complete range of sizes matched to the new line of International TracTracTors, has recently been introduced by Bucyrus-Erie Company, So. Milwaukee, Wisc. To simplify operation, to lessen chances for breakdowns and time losses, and to keep maintenance costs at a minimum, these scrapers are so designed that they have only five main parts, consisting of: (1) Frame with sideplates, (2) tilting bowl, (3) apron, (4) tongue assembly, and (5) rear axle assembly.

Using two-line cable control, one cable to control height of digging edge, and the other to control the opening of the apron and tilting of the bowl, these scrapers give accurate depth of both digging and spread. The cutting edge holds the same angle at all times while digging, and, because a practically constant wheelbase is maintained throughout the cycle, there is always uniform straight line pull from tractor drawbar to the cutting edge.

## Pilot Plant for Ozone Treatment

A 1 mgd. pilot plant will be installed by Ozone Processes, Inc., Philadelphia, Pa., to treat water at the Lower Roxborough filtration plant. Construction begins at once, and the test plant is expected to be in operation by Aug. 1. The plant will have a total generating capacity of 20 pounds of ozone daily. Complete cost is estimated at $25,000, including construction, installation, operating and laboratory expense over a period of one year; of this, the city has contributed $10,000 and Ozone Processes $15,000.

## Improved Garbage Receptacle Holder

A base and cover for holding garbage cans and protecting them against dogs, flies and rats has been developed by S. W. Swanson, 731 Allen Ave., Rapid City, S. D. The base is slightly smaller than the receptacle, and from it two rods extend upward to hold the cover, which may be locked shut or held open as desired. Any good garbage can may be used with this base and cover. Full data on request.

## LeTourneau Southern Factory Completed

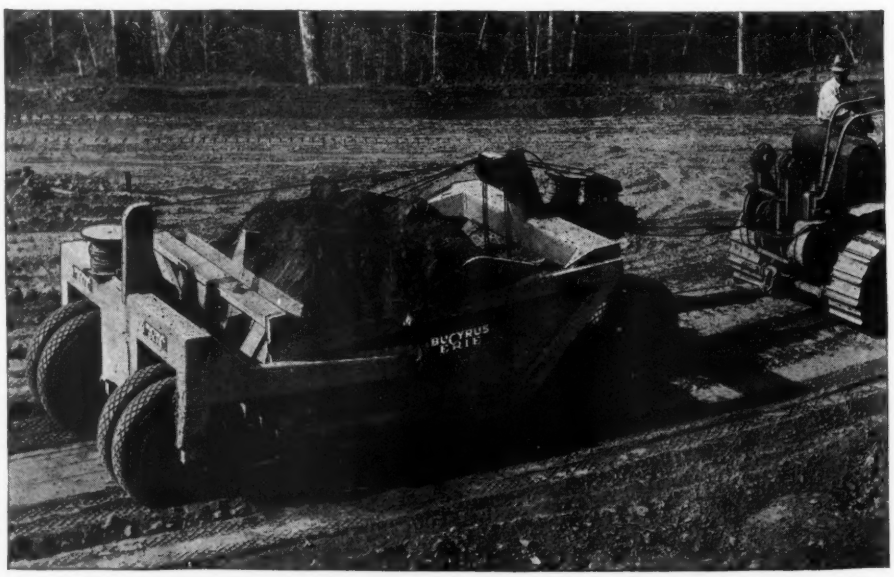
R. G. LeTourneau, Inc., Peoria, Ill., has just completed the new factory at Toccoa, Ga. This plant, which will manufacture the Tournapull, a big dirt-moving unit, is of pressed steel, arc welded. An office building 115 by 161 ft. is entirely without windows. Shadowless lamps furnish the lighting, while the building is completely air conditioned.

## Apologies to Jeff Corydon

In the work of getting a magazine ready for press, errors do creep in. There was one such error in a paragraph in the advertisement for Proportioneers, Inc., 9 Codding St., Providence, R. I., which appeared on the back cover of the May Public Works. The paragraph should have read as follows: "XSDeCHLORINATION — (excess and de-chlorination). High chlorine dosage (beyond the "burn-point" in the chlorine "residual-versus-dosage" curve) that is, superchlorination, is becoming widely known as a means of taste and odor control. The excess chlorination oxidizes the taste producing organic matter. Chlor-O-Feeders are useful for feeding the excess chlorine and for feeding sodium bisulphite for the dechlorination frequently used to remove chlorinous taste.

## Distributors for General Excavator, Osgood and Hercules

Distributors have been appointed for General Excavator Co., Marion, O., as follows: C. Taylor Handman, Cincinnati, O.; Teford Equipment Co., Lansing, Mich. For the Osgood Co., the following distributors are announced: Machinery Rental and Sales Co., Kansas City, Mo.; C. Taylor Handman, Cincinnati, O.; K. B. Noble Co., Hartford, Conn. For the Hercules Co., Intermountain Equipment Co., Boise, Idaho.




Bucyrus Erie 4-Wheel Scraper

## Personal News

The following new appointments for water works superintendents have been reported:

P. J. Stacey, Nogales, Ariz.
H. C. Meddles, Winslow, Ariz.
Phillip Bragg, La Junta, Colo.
Clifford Norman, Bedford, Ind.
Lew Pauley, Martinsville, Ind.
William J. Almond, Randolph, Mass.
Harry McNutt, Lincoln Park, Mich.
Walter Villmer, DeSoto, Mo.
C. E. Schanze, Joplin, Mo.
W. Hane, Mexico, Mo.
E. Feldman, Washington, N. J.
Joseph Grieble, Liberty, N. Y.
D. M. Williams, Durham, N. C.
O. Kalbfleisch, Mansfield, Ohio.
J. F. Bearden, Walhalla, S. C.
H. W. Chase, Colfax, Wash.
Edward Drewery, Elkhorn, Wis.
Henry Pretti, Hurley, Wis.
S. H. Sutton, Adel, Ga.
J. L. Leggett, Baxley, Ga.
W. A. Peavy, Byron, Ga.
T. F. Chasteen, Chauncey, Ga.
O. G. Allen, Clarkesville, Ga.
F. L. Gunn, Crawfordville, Ga.
Miles Wolfe, Cumming, Ga.
Geo. E. Howard, Darien, Ga.
L. R. Hester, Dawson, Ga.
T. R. Shiver, Dudley, Ga.
G. M. Kilpatrick, Forest Park, Ga.
W. L. Beck, Gordon, Ga.
C. R. Bowen, Gray, Ga.
O. N. Coker, Hampton, Ga.
S. P. Sheffield, Kingsland, Ga.
J. H. Baskin, Lakeland, Ga.
W. S. Macomson, Lavonia, Ga.
H. S. Stanley, Lyons, Ga.

The following county engineers have been appointed:

D. E. Smith, San Juan County, Silverton, Colo.
J. C. Horton, Wayne County, Monticello, Ky.
Forrest Mallory, Muhlenberg County, Penrod, Ky.
Daby Surgernor, Elliott County, Sandy Hook, Ky.
John Greason, Butler County, Poplar Bluff, Mo.
B. Kesting, Tama County, Toledo, Ohio.
W. B. Sansom, Real County, Leakey, Texas.

The following new appointments as city managers have been reported:

Ray L. Billings, San Leandro, Calif.
E. H. Knight, Comr. Public Works, Sarasota, Fla.
E. C. Peterson, Middleboro, Mass.
R. L. Cookingham, Kansas City, Mo.
James P. Whiskeman, Commissioner of Public Works, Peekskill, N. Y.

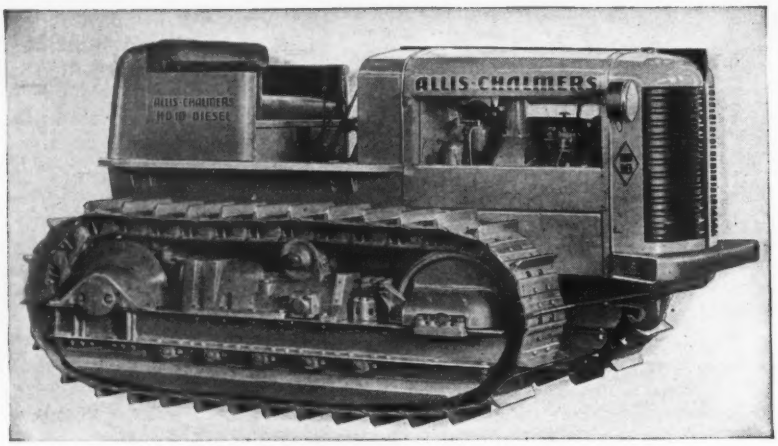
The following new appointments as city engineers have been reported:

Geo. W. Stevens, Culver City, Calif.
Joseph E. Johnston, Kissimee, Fla.
Alonzo B. King, Frankfort, Ind.
E. D. Canatsex, Martinsville, Ind.
Walter D. Main, Newcastle, Ind.
Robert E. Gibbons, Terre Haute, Ind.
C. C. Clark, Neodesha, Kan.
Frank A. Blackstock, Lawrence, Mass.
M. B. Lang, St. Cloud, Minn.
M. R. Akers, Tupelo, Miss.
J. P. Sparks, Kirkwood, Mo.
J. Horace Eaton, Bordentown, N. J.
David R. Cascino, Garfield, N. J.
John Gouin, Las Cruces, New Mex.
M. Frank Dullea, Auburn, N. Y.
Herman G. Kuhn, Tiffin, Ohio.
Artie Marvel, Idabel, Okla.
Guy B. Walker, Wilkes-Barre, Pa.
George R. Brooks, Clarksburg, W. Va.
Archie E. Becher, Wausau, Wis.
A. J. McGaw, Laramie, Wyo.

Hal G. Sours, assistant director and chief engineer of the Ohio Department of Highways, was installed as president of the American Road Builders' Association at the annual meeting held in Washington, D. C. Mr. Sours has been active in association work for the past twelve years, and is well known.

Lewis V. Carpenter, widely known professor of sanitary engineering, New York University, N. Y., died at his home after a long illness, aged 45. Coming to New York about 5 years ago, he became one of the best known, beloved and respected men in the sanitary engineering field.

M. F. Wirtz, founder and president of the Atlas Mineral Products Co., Mertztown, Pa., died recently at his home, aged 71.




New Allis-Chalmers Diesel Tractor

## Allis-Chalmers HD10 Diesel Crawler Tractor

A new Diesel crawler tractor—the HD10—has been introduced by Allis-Chalmers as a companion model to the HD14. The four cylinder GM 2-cycle diesel engine provides 86 belt horsepower and 71.2 drawbar horsepower with drawbar pulls up to 17,600 lbs. The tractor is available in two tread widths, 62 and 74 inches, with the narrow model weighing 19,900 lbs. and the wide model weighing 20,700 lbs.

The HD10 is designed to handle two and four-wheel scrapers up to 10-yard capacity, 12-foot blade graders, bulldozers, trailbuilders, winches, logging arches, and other allied equipment. A folder describing this new Diesel tractor may be obtained from the Tractor Division, Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin.

## Bucket for Cleaning Sewer Catch Basins

Hayward Co., New York, N. Y., has designed a novel and effective bucket for cleaning catch basins quickly and without nuisance. This bucket can be used with a hand hoist or with a power hoist. A new bulletin shows this machine at work and contains many illustrations. Also gives sizes of buckets, dimensions and other data. Ask for Bulletin 805, which will be sent on request.

### Foto-Facts on Blacktoppers

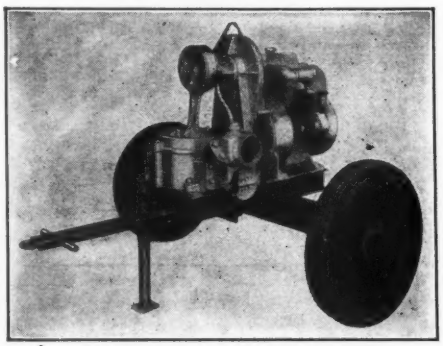
This is a new pictorial catalog, issued by E. D. Etnyre & Co., Oregon, Ill., which illustrates the 1940 line of three distributor models. Because this is an unusually costly catalog, it is being sent only on special request by "select" prospects.

### Heavy Duty All Wheel Drive Trucks

A folder descriptive of Marmon-Herrington heavy duty, all wheel drive trucks has been issued by the Marmon-Herrington Co., Inc., Indianapolis, Ind.

## Mobile Diaphragm Utility Pump

This is a utility pump mounted on a high speed trailer, with pneumatic tires. With 10-ft. suction lift, the 3-inch pump has an AGC rating of 3,000 gph. and the 4-inch of 6,000 gph. This unit is



Novo Trailer Pump

especially intended for emergency pumping for water or sewer departments, and for general utility work. Made by Novo Engine Co., Lansing, Mich. Ask for Bulletin 77.

## Chrome Face, The New Steel Tape

Chrome Face is the name of the line of steel measuring tapes that has just been put on the market by The Lufkin Rule Company, Saginaw, Mich. Their markings are durable as well as easy to read. They are chrome plated, with jet black markings and satin-chrome white surface, unusually free of glare. Hence, the permanent markings stand out in sharp contrast, showing up well even in poor or artificial light. Furthermore, being built up by chrome plating, these tapes are extra strong and resist rust. The surface


Lufkin Chrome Face Tape

is smooth, hard, and easy to clean, and the tape, being of metal throughout, will not crack, chip or peel. New cases and frames of improved design and appearance have been built for this new line.

## Haiss Loader on Pneumatic Tires

The George Haiss Mfg. Co., New York, N. Y., has a new loader which will handle up to 3 cu. yds a minute. It is highly mobile and especially suited for maintenance jobs where stockpiles are placed at intervals along the road. The discharge chute has a 10-ft. clearance to load into big trucks. Full information on request.

This new bucket loader has pneumatic tires and loading ability plus.